SHORTENING THE DEFENSE ACQUISITION CYCLE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

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C O N T E N T S

SHORTENING THE DEFENSE ACQUISITION CYCLE

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HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
Washington, DC, Tuesday, October 27, 2015.

The committee met, pursuant to call, at 10:00 a.m., in room 2118, Rayburn House Office Building, Hon. William M. "Mac" Thornberry (chairman of the committee) presiding.

OPENING STATEMENT OF HON. WILLIAM M. "MAC" THORN-BERRY, A REPRESENTATIVE FROM TEXAS, CHAIRMAN, COMMITTEE ON ARMED SERVICES

The CHAIRMAN. Committee will come to order. Appreciate our members, witnesses, and guests for joining us today on this hearing related to acquisition reform. As you can tell, there are party conferences still going on, and so members will be coming in as those conclude.

Let me just say that a major priority for this committee has been, and will continue to be, improving our acquisition system. Partly, it is to help get more value for the taxpayer dollars. In my mind even more important, is to have a more agile system that can better respond to the myriad of complex national security challenges facing our country.

And it is at least my belief that unless we improve our acquisition system, we cannot keep up with the many challenges that we face. At the same time, while we are trying to improve our acquisition system, the acquisition process has to work every day. You have got to get that rifle into the hands of that soldier in Afghanistan and do all the other things that are required of the system.

And so, I believe we can't have a 2,000-page bill that fixes acquisition. We have to take it a step at a time. I think we made some good progress, good first steps in the fiscal year 2016 National Defense Authorization Act, working on some of the basics when it becomes law.

But there are more steps to go, and that is the reason for today's hearing, to benefit from the experience and wisdom of our distinguished witnesses on next steps, and direction for the acquisition reform efforts undertaken by this committee and the Senate committee, working with the Pentagon. One thing everybody agrees on is that we have got to do better, and so largely this has been a cooperative effort.

Let me yield to the distinguished gentlelady from California for any comments she would like to make on behalf of the ranking member.

STATEMENT OF HON. SUSAN A. DAVIS, A REPRESENTATIVE FROM CALIFORNIA, COMMITTEE ON ARMED SERVICES

Mrs. DAVIS. Thank you, Mr. Chairman. I am delighted that you are all here today. We appreciate it very much.

On behalf of the ranking chair, Mr. Smith, I wanted to submit his statement for the record and also acknowledge how difficult it is to find that appropriate balance between the acquisition cycle time, and risk. We know that needs to be done. And also, how do we nurture innovation and developmental testing within the acquisition cycle. That is also a big concern and something that he notes in this particular statement.

Again, thank you very much for being here. We look forward to your testimony.

The CHAIRMAN. Thank the gentlelady.

[The prepared statement of Mr. Smith can be found in the Appendix on page 45.]

The CHAIRMAN. We will now turn to our witnesses, Mr. Andrew Hunter, director of Defense-Industrial Initiatives Group at Center for Strategic and International Studies [CSIS]; Dr. David Chu, President of the Institute for Defense Analyses [IDA]; Mr. Joe Pasqua, member of the Business Executives for National Security [BENS]; and Mr. Paul Francis, managing director for acquisition and source management from the Government Accountability Office [GAO].

Without objection, your full written statements will be made part of the record, and I would ask each of you to summarize them at this point before we go to questions.

Mr. Hunter, I guess we are starting with you.

STATEMENT OF ANDREW HUNTER, DIRECTOR, DEFENSE–INDUSTRIAL INITIATIVES GROUP, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

Mr. HUNTER. Well, thank you, Mr. Chairman. And it is really a pleasure to be back here at the committee where I spent so much time learning from members like yourself, some of whom are still here and some of whom have departed the Congress. But it is a pleasure to be back.

And I commend the committee for its focus on acquisition reform, which is, I know, a focus of longstanding, but remains a very important focus, and obviously one that brings you into alignment, as you mentioned, with the leadership of the Senate Armed Services Committee and with the leadership of the Department of Defense.

And I do believe there is a golden opportunity here with this meeting of the minds or alignment of focus to make some real progress. And certainly at CSIS this has been a focus for us as well, so it is something that we share.

The focus today is on "faster." I want to briefly mention the fact that acquisition is about balancing priorities. And so the old saw, "Faster, better, cheaper: Pick any two," is something that I just want to start and mention that in picking "faster" you have to be willing to sacrifice at least one of the other two. And when I say "sacrifice," I mean deemphasize or make a lower priority. And so if you are going "faster," then either "better" or "cheaper" has to

sort of be willing to give a bit in order to achieve a significantly faster outcome.

Now, of course, when I say "sacrifice," when I mean "better," better meaning not necessarily the highest end of capabilities. If you have a really old system, the new system you are buying is almost certainly going to be better than the one you are replacing, but it may not be the state of the art of the most latest technology. And these priorities shift over time.

And in the Cold War, in most cases, "better" was often the priority. I use in my written testimony the example of the B–2, which was innovative in almost every way as it was built and conceived and constructed, and that meant that it was expensive. And there was a major schedule delay in that program particularly because they changed the requirements in the middle of the development. And that was a choice that was made because "better" was what mattered then.

In the most recent time period, with the wars in Iraq and Afghanistan, "faster" has certainly been a priority. In my time at the Department of Defense, part of which was as director of the Joint Rapid Acquisition Cell, was really all about moving faster. And the Department achieved quite a bit of success in that, and I will get into that, because I think that is something that there are lessons learned that we need to take away from that.

But I do want to mention that in the time that we are in today, "faster" is not the only priority. We have an erosion of U.S. technical superiority that has been taking place over a number of years for a number of reasons, and we explored what some of those reasons are, in a CSIS report released over the summer.

And that is a case where we do need to be fielding at least some systems that are in the "better" category, where "better" is a priority so that we can maintain a technological advantage, which is part of our strategy. And also with the budget crisis that is currently being dealt with in the Congress, and maybe there is hopefully some progress being made there, "cheaper" has to be a priority for some systems. So your system has to be able to focus on different priorities for different systems at the same time.

Within my time as director of the Joint Rapid Acquisition Cell, we tried to capture the lessons learned from rapid acquisition. This was something that really spun up at the Department of Defense in the 2005 timeframe. And I came in, in 2013 as director of the Joint Rapid Acquisition Cell when we were trying to capture the lessons learned and trying to institutionalize those lessons. And Secretary Gates in his testimony last week made reference to the desire to institutionalize those lessons.

And I would draw your attention to the article in Foreign Affairs Magazine that Dr. Carter published in 2013 which goes into the lessons that he took away and how he tried to institutionalize those. And I would ask, if you are willing, that that might be made part of the record for this hearing, that article.

[The information referred to can be found in the Appendix on page 95.]

Mr. HUNTER. The keys that we identified at that time, the first is flexible funding. By and large, when you are working through the Department's regular budget process, it takes 2 years to get

money to start. So that is an immediate 2-year delay in the system. Now, there are certain ways around that, but they are cumbersome and they are difficult, and they make it hard to move fast.

And the Congress was very generous during the war period of establishing flexible funds like the MRAP [Mine-Resistant Ambush Protected] Transfer Funds and the Joint IED [Improvised Explosive Device] Defeat Fund, but those funds are really going away. And so exploring how to extend flexible financial support for programs that need to move fast is definitely an area of focus.

Second big area was getting the senior leadership of the Department involved and shortening the lines of authority, and that was really what was called the Warfighter Senior Integration Group that the Department did during the war years, and I think that is an excellent model for programs that matter to move fast. And that model is being somewhat echoed in the Long Range Strike Bomber program the Air Force is about to initiate with the way that they manage their Rapid Capabilities Office.

And then the third priority is basically continuous communication between the acquisition community and the operational community about requirements, about testing, about what is acceptable, and about what the art of the possible is with technology, and whether that is acceptable to the warfighter. Those three lessons are very much applicable to rapid acquisition, but they are applicable more broadly.

And the last thing I want to leave you with is the idea of adaptable systems. If we are always trying to figure everything out for the next 30 years today and plan that all in, that is a real challenge. That is slow. That is just an inherently slow process.

And so focusing on adaptable systems that can evolve over time where you don't have to have the full answer right when you start is a good way. And I would use the Predator system as an example of how that has actually happened in practice. And that system has evolved in a revolutionary way over time, and that is, I think, an example to say.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Hunter can be found in the Appendix on page 47.]

The CHAIRMAN. Thank you.

Dr. Chu, welcome back to the committee.

STATEMENT OF DAVID S.C. CHU, PRESIDENT, INSTITUTE FOR DEFENSE ANALYSES

Dr. CHU. Thank you, Mr. Chairman. I appreciate the opportunity to be part of the panel this morning.

Let me try to summarize my written statement under three headings: First, what do we know about cycle time defined as the time from the start of a program until initial operational capability is achieved; second, to the extent there are issues with cycle time, what are they; and third, what can we do about those issues.

Looking at the Selected Acquisition Report data of the last 25, 30 years, I do not see any trend in the cycle time. Cycle time has been relatively stable, 8 to 9 years over that period. Our impression is very different, perhaps because some very large programs have

taken a long time: F–22, V–22, and F–35, which, of course, is not completely finished with its development program.

To the extent that there is dissatisfaction with cycle time, I think a good deal of the source lies in the definition of the program at the start, what people like to call the requirements process, a term I actually would urge we drop. Because, in fact, we are always picking a point in the space of trades among the various features of the system concerned.

And our real interest ought to be how well the system performs against the mission needs for those in the field who are going to get it. Too often, from a technical perspective, looking back at history, we pick a point in the trade space that is too tough to achieve from a technological perspective within the timeframe that we might desire.

And that tendency is exacerbated, I would argue, by the incentives facing those responsible for the system, starting with the program manager. We reward program managers for getting programs to production, not for helping the system make a good decision, which in some cases, is to admit we have made a mistake and the program ought to end.

The services, likewise eager to have as much content within the fiscal guidance as they can possibly achieve, tend to plan for more than can actually be financed. And the companies look to production for the source of their return on capital have every incentive to be optimistic about development time and development needs.

If those are the sources of our dissatisfaction, what can we do about them? First and foremost, I think at the start we ought to take what some of my colleagues have called a physics-based approach to setting the technical parameters. What does the trade space look like? What point within that trade space do we want to select?

Second, as Mr. Hunter suggested, as one of my colleagues has phrased a bit edgily, we should prepare to be wrong. We should build systems knowing—especially the major platforms—knowing that we are likely to want to change them to aim at block upgrades across their lifetime, that means allowing for extra space, weight, power, et cetera, in the original design.

To be sure that we have picked the parameters thoughtfully, I think greater emphasis on development testing is essential. The Department System Acquisition Reform Act of 2009 called for that, and the fiscal year 2016 National Defense Authorization Act strengthens those provisions.

And finally, I think we ought to rethink the incentives that face the program managers and the services as well as the companies that produce the articles to emphasize, much as Intel does, as I understand it, that really the rewards are to go to those who give good advice, and sometimes that advice is the program is not meritorious, that not every program started ought to go to a finish.

Let me offer three observations very briefly in conclusion. First, I think the emphasis I would urge is less on whether or not we shorten the cycle time and more on understanding how do we pick the best cycle time for the need that we face. In some cases, we want an article urgently, we are willing to give up certain elements of performance in order to get that, or certain elements of long life

that we would otherwise seek. MRAP is an excellent case in point. MRAP was achieved fairly rapidly, but was an article we decided not to retain, and we discarded approximately $40 billion worth of equipment. Some additional bias for flexibility will be helpful in shortening cycle times for those articles we want quickly.

Second, I think it is essential to keep our focus on mission performance as the ultimate standard, not on the technical parameters per se. It is the mission needs that are crucial. That includes, of course, deployment deadlines when those are significant.

And finally, as Secretary Gates' testimony, I would argue, last week at the Senate Armed Services Committee contended, perhaps the most important ingredient in success is the human capital, the quality of the people managing the system and the technical staff that support them, an issue, I think, that the National Defense Authorization Act for this fiscal year recognizes.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Chu can be found in the Appendix on page 60.]

The CHAIRMAN. Thank you.

Mr. Pasqua.

STATEMENT OF JOE PASQUA, MEMBER, BUSINESS EXECUTIVES FOR NATIONAL SECURITY

Mr. PASQUA. Chairman Thornberry, members of the committee, my name is Joe Pasqua, and I am honored to be here today as a private citizen to address you.

Having been asked for ways to address shortening of the defense acquisition cycle, my statement today will focus on how the private sector has addressed similar challenges and increased their ability to adopt innovation quickly.

My testimony is based on over three decades in the information technology, the IT industry, and also as a member of BENS, Business Executives for National Security, which is a nonprofit, nonpartisan organization that for over 30 years has been a conduit through which private sector leaders can help build a more secure America. Although the opinions I am going to express today are largely reflective of BENS's perspectives, the views I express are my own.

I would first like to commend the committee's efforts at acquisition reform. I agree with Chairman Thornberry's approach to make incremental and achievable changes as a path to comprehensive reform. Because of the central role of IT in virtually all modern systems, the ability to efficiently specify, acquire, and adopt IT innovation has become a key success factor. Smaller, more agile companies are often the best sources of innovation; however, they can often be the most difficult to identify and engage with for large organizations.

In the past, barriers for both the Department and these small companies have impeded building effective relationships. Traditionally smaller companies haven't viewed DOD [Department of Defense] as a viable customer because they lack the specialized knowledge and the time that is required for operating in this space. It is not that they don't want to engage with DOD; it is just that it is too high a risk for these still small businesses.

So the question becomes, how are private sector companies addressing similar challenges? Over the last 5 to 7 years, there has been a fundamental change in the way that they specify and acquire IT. The rapid pace of innovation has made long, expensive requirements processes untenable. As a result, we are seeing less of what I referred to as "big bang" acquisitions; instead, companies are starting small, conducting iterative evaluations in real time, and adjusting as needed. Advances in cloud computing, scale-out architectures, and other technologies have enabled companies to test concepts quickly and purchase IT hardware as they need it rather than buying everything upfront.

This has been a challenge, quite frankly, for large organizations with high inertia and low risk thresholds. But even with these larger organizations, we are seeing that they are becoming more agile as a way to keep pace in a competitive marketplace. This shift has lessened the bias towards large, incumbent vendors and has given innovative new players a better opportunity to compete.

This new approach also helps to remove risk by keeping the initial investments small. Traditional requirements processes attempt to mitigate risk by conducting long-term, expensive studies to ensure all options, every conceivable outcome can be reviewed in advance of a decision. In contrast, an agile approach allows companies to start small and scale up as appropriate, thereby reducing the need for protracted requirements processes.

In fact, a traditional process has a different sort of risk, the risk that by the time a long acquisition process is complete, the solution that is chosen will no longer be appropriate. Nowhere is this more true in cyberspace where the threat landscape is changing on a continuous basis. In such a dynamic space, the requirements process needs to account for an organization's current needs and be able to adapt to the inevitable changes that will come. This is one reason why open architecture is so important. It provides increased interoperability, modularity, and the ability to incorporate new technologies without overhauling an entire system.

In summary, I believe that these practices and understanding and implementing these approaches would help the Department to become more agile and responsive to innovation, allow a slightly different, yet still very good risk mitigation strategy, and encourage participation from a wider segment of industry.

Thank you for the opportunity to speak today, and I am prepared to answer any questions you may have.

[The prepared statement of Mr. Pasqua can be found in the Appendix on page 71.]

The CHAIRMAN. Thank you.

Mr. Francis.

STATEMENT OF PAUL L. FRANCIS, MANAGING DIRECTOR, ACQUISITION AND SOURCING MANAGEMENT, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Mr. FRANCIS. Good morning, Mr. Chairman, Mrs. Davis, members of the committee. I appreciate the opportunity to talk about weapons system acquisition this morning.

I think we know the overall problems being, weapons systems cost more and they take longer than expected. They perform well

but generally not quite as well as we thought. I believe some of the top-level consequences are understood, that is the warfighter is somewhat underserved by systems that come late and buying power is reduced.

There are other consequences maybe that are less well understood; that is, when we pay more for a weapons system than we thought that we would in the beginning, we are making tradeoffs. We are deciding not to do other things because we are putting more money into this one system. And those opportunity costs I don't think are explicit or the tradeoffs are looked at, so we are not quite sure what we are giving up to put more money into system A.

The other thing is, weapons systems typically take more to operate and support than we think. They are a little less reliable. Again, those costs are kind of hidden once the acquisition is done. So, some consequences not so clear.

Our position is that the key to getting better acquisition outcomes, whether they are shorter cycle times, or as Dr. Chu mentioned, the right cycle times, is a better business case at milestone B. And I will talk about a business case in two parts: One is, what happens before milestone B. And that is when you are sending requirements and you really need your requirements to be—they need to be clear, flexible, but well informed by a couple of things: One is technology knowledge. How much technology is available to meet the requirement; and your engineering expertise. Do you understand the implications of the requirement for the design?

So if you come to a milestone B and you are asking for technologies that aren't mature yet, or you don't quite understand the implications for the design, you are in trouble. If you do come to milestone B with a pretty well-informed, reasonable set of requirements then you are kind of ready for the second half. And the second half of that is, what is your game plan going forward.

And we would say the second part of that business case then is a knowledge-based acquisition strategy that lays out a logical path for getting the design stable, building prototypes, testing, maturing the design, maturing production processes, and laying that out with the schedule and resources that allow that to be done nonconcurrently.

So, you ask yourself, well, why aren't we getting these kind of business cases routinely? Which is the David Packard question. We all know what needs to be done; the question is, why don't we do it? And I would say what I just described is a sound business case, but a sound business case isn't the same as a successful business case. And a successful business case is one that wins money.

And I still think predominantly in the Department, a successful business case is one that overstates or overpromises performance and understates cost and understates schedule. That is what still wins money today. And I would say the reason for that is there is still strong incentives, which we refer to as the acquisition culture in the Department, that put pressure on these kind of business cases.

And I will give you a couple examples of what is kind of under the hood. First is the competition for funds in the Pentagon is pretty intense to start a new program, so that does create incentives

to overpromise performance and understate the investment cost. Also, weapons systems are highly symbolic. They are more than just a piece of equipment at the right price. They involve policies, roles and missions, careers, jobs, budget shares, so they carry a lot of weight.

If you look at the private sector, when the private sector does a product development, it is an expense. They are spending their own money to finance the development and they don't make any money until they get into production. So that creates real incentives to get the business case right, because if they are late, the customer walks. If you are Ford and you build a Ford Taurus that is 5 years late, it has a $50,000 sticker price and it gets bad gas mileage, your customer walks, and the investment is lost.

And the Department of Defense, when you get a program started, it is a revenue stream. It is not an expense. So you get a bigger budget share. And those incentives then are quite different. And at the end, the customer isn't going to walk. So if it costs too much, it takes longer, it underperforms, the customer is still going to buy.

So in the private sector, the point of sale is after development when you are in production. In the Department of Defense, the point of sale is at milestone B. In fact, I would say it is before milestone B when you first approve funding. So it is a completely different psychology.

That is why things like—practices like cost estimating, everyone wants—or you would say policy says we should have good cost estimates. We all know how to do a good cost estimate. But they don't really help your business case. They are pretty inconvenient if they are high. Same is true for a fly-before-buy in testing. You would want early test results to see how good the system is, but they could be inconvenient as well.

So I think the real kicker is, to the extent business cases like this win funding approval they are sanctioned, and those principles then become what policy is, not what is in best practices or DOD policy.

So what to do, I would just say let's start thinking about the acquisition process as not something that is broken but something that is held in equilibrium by a set of incentives that are stronger than best practices. You know, moving forward there is a number of things we can do, we will probably talk about that more this morning, but it is going to take joint action on the part of the DOD and Congress.

And I will just list a few things. One is we need to separate technology development from product development; we need to take risks in the right places, which I would say is early in programs; and if we have to take a risk on a program after milestone B, let's declare them and pay for them. Let's take the risk together and be honest about them.

We have to do something about better aligning funding decisions with program decisions, because today you are having to make a funding decision 18 months in advance of a program decision. So once you put money on the table you can't take it off. We really need, as Dr. Chu mentioned, a really good investment in program managers and systems engineering staff.

And then finally, I would say my hope, my appeal is to Congress to be the game changer in acquisition reform and that will be manifested by what you do in funding programs. So I would say for programs that don't measure up to good business cases, say no. I think a couple of good no's in the process from the Congress is going to send the right example as to what you expect.

So that is my hope. I am looking for you to be the game changers. Thank you, Mr. Chairman.

[The prepared statement of Mr. Francis can be found in the Appendix on page 79.]

The CHAIRMAN. Thank you.

I just want to ask each of you to comment, because each of you have touched on this in the comments that you have made so far. And one of the concerns that I have heard over and over is, especially for complex systems, we invent as we are in production. Dr. Chu said we reward programs for getting into production. Mr. Francis was just talking about this. So the incentive of the current system is to get that program past the milestone B, that is where you get the dedicated line of funding, and the incentive is to do that even if the technology has not been developed that you are going to rely upon.

And so, part of what happens is you are inventing as you are producing, and that results in delays, cost overruns, and so forth. So the suggestion has been made to me that if you separate technology development from production and you don't take anything to production until the technology is established and proven, that maybe you could improve that situation with the adaptability that you all talked about so that as improvements in technology are developed, then you can plug it in.

So Mr. Hunter, what is your reaction to that? I mean, part of what we are trying to do is get below the symptoms, the surface here, and dig down into deeper root causes that have caused people concern. Is this a root cause, and is that something that together we should explore with the Pentagon?

Mr. HUNTER. Well, I would say it can be a root cause and that does happen. And the example that jumped into my mind as you were laying that out is the example of the F–35 helmet, which I would say was not mature technology in the early 2000s when the program went through milestone B and the investment decision was made and the decision to take that approach was made, but which is now actually working.

And so some 15 years later it is there but it probably wasn't there when we made the decision. So it does happen. It is a cause. It is not the only root cause but it is a cause. One note I would make about that and something they did there that actually was a good idea, although I think it was belated, is they had an off ramp and they had a second helmet that they could have gone with if the original helmet didn't work. And that, I think, is a good practice.

There are times when you want to reach a little bit, as I mentioned when "better" is the priority. It is not clear that on F–35 that was really the intent, but where it is a priority you may want to reach. But what you can do is have off ramps, so that if you are not able to invent the thing you were trying to invent, you still

have a workable system and it still meets your threshold requirements.

And I also think, you know, as I mentioned this idea of adaptable systems to where you may be trying to invent something, but again, you don't put it in the baseline design. It is in a later block. It can be a way when you are trying to reach for new and innovative technology.

The CHAIRMAN. Dr. Chu.

Dr. CHU. I would add two thoughts to the general idea that you advanced. One, reinforcing, which is there in various congressional direction the last several years, and that is a greater emphasis on development testing. We don't do enough testing early on of the technology ideas to be sure that they are going to pay off in the way we think.

Second, I think, again, back to deemphasizing the word "requirements," too often we pick a technological point and we follow these attributes forgetting that in the end what counts is does it add to mission success or not. And there are a number of systems where we have picked points that actually don't have a lot to do with mission success but we keep pursuing them in the systems development even though they are not going to have a high payoff, and that often is the cause of serious difficulty.

The CHAIRMAN. Okay. Mr. Pasqua, I want to come back to you in a second with the private sector.

Mr. Francis, what do you think?

Mr. FRANCIS. I think it is definitely one of the big root causes. I think part of the solution lies in the fact that we have to enable those technologies, so we do have to take those risks to make those gains. So we are not arguing against that, but the burden needs to be borne more heavily in the science and technology community. And we typically aren't funding it to carry technologies that far.

And the mechanisms we have to transition technologies to programs aren't very good. So programs are a better place, if you will, to fund the programs, which is not what we want. I also think when programs are doing their analysis of alternatives, there is incentives to advertise very high performance, which means you are counting on technologies that haven't been invented yet.

So I think we can go forward, bring technologies to higher level before milestone B. If we still have to take risks, let's take the risks and pay for them upfront. Or, as I think Mr. Hunter was suggesting, go forward with the design that is flexible enough that you can bring in improvements in technologies during the course of development.

The CHAIRMAN. Okay. Now, Mr. Pasqua, how does all this comport with your experience in the private sector? And is this, kind of what we have just been talking about, a path towards a more agile system, in your opinion?

Mr. PASQUA. I think it translates very well to the private sector, particularly with technology. It is sort of well understood that the further on you get into a technology development cycle, the costs of changes and finding and fixing problems increases close to exponentially.

So you want to make sure that you are doing as much cycle work as you can upfront to get your technology in place and in a mode

where it is operable, it can be adapted and modularized, but you don't want to be making changes during the production cycle, you don't want to be redoing the architecture during the production cycle. That is the absolutely most expensive time to deal with those types of issues.

So the idea of being more agile upfront, being able to test systems before they are in production, before you get into the most expensive phase for changes, is, I would say, an industry best practice.

The CHAIRMAN. Thank you. Thank you, all.

Mrs. Davis.

Mrs. DAVIS. Thank you. Thank you, Mr. Chairman.

And I appreciate all of your input here.

I think one of my questions, and perhaps both in business and in the Department, the extent to which we rely on people who have done those things before, and with the idea that they will be able to move forward, you know, do you see in business particularly putting folks on the project who maybe haven't been there before? I mean, is there something to be said for we really do need in management to bring in—talk about different eyes on the issue. Do you see that happening in the business, that you are able to do that more than perhaps in the public sector?

Mr. PASQUA. Well, I can't compare to the public sector because I can't speak with authority on how often that happens, but it is definitely the case that having a fresh perspective is always a good thing. But having people who have—are experienced with the process and know how the process works and can operate efficiently in it, I think, is very important.

I think what we are seeing in industry is sort of a bridge being built between the people and the way processes had operated for many, many years, and a transition to the way they are operating now. And I think part of the way that is happening, particularly in large organizations, is they are looking at smaller organizations and wondering how these smaller organizations are so much more effective than they are, and trying to understand which sorts of processes can be adapted from those sort of more agile companies into a larger organization.

It is not easy, frankly. The things that work in a smaller organization often don't translate directly to a larger organization. But as Dr. Chu was saying, I think that one of the critical things is always keeping in mind what the end goal is.

So as organizations are focusing on not what's written in a document somewhere about, you know, specific sets of requirements but actually what they are trying to achieve in the marketplace or for their customers or for their patients or clients and being able to adjust based on that north star of what the actual goals of the projects are rather than specifically the detailed requirements is one thing that I think is changing industry in a positive way.

Mrs. DAVIS. Uh-huh, yeah. I don't know, Dr. Chu or even Mr. Francis, does sometimes just the culture get in the way of that?

Dr. CHU. I think there is an issue there with the human capital, and that is that as the number of new systems has declined over the last several decades in at least several platform areas, private aircraft being a principal example, it is less the case as was earlier

true that the design engineers have prior experience with that design problem.

And so we move from a situation where United States and let's say the 1950s, 1960s science engineers have frequent opportunities to try out new design ideas and experience with the ups and downs of that process to—they may do one or two designs in an entire career.

And so that base of hard-won lessons from things that didn't go so well is not as frequently there, and I think that is one of the issues out there. I think that does lead to a different kind of technology separation production, which is perhaps more emphasis on prototypes and prototypes for their own sake, to try out technologies and to give the design teams more experience with the tough issue of how you actually make these trades work.

Mrs. DAVIS. Thank you.

Mr. Francis, is the reason that we tend to build on immature technologies that there hasn't been this sort of change in terms of looking at something, I guess, different from what they have done in the past? How would you solve that, I guess?

Mr. FRANCIS. Well, I think that is part of the problem. I think the issue with program managers is a real one. I think we are putting really outstanding people in those positions, but we are often handing them an impossible situation. So we hand them a business case that no one could execute.

We are not really giving them the training and glide path to put them in a position and really have the business acumen to do business with their private sector counterparts. And then we are not giving them a really good career path. So we don't put program managers in a good position to succeed, so that is a remedy that we need.

The other part, touching on your technology, is we are still short on systems engineers in the Department, and we particularly need that expertise before a milestone B decision so that you can work with those requirements and understand the preliminary design. So I think the work doesn't get done early, it falls on the shoulders of the PM [program manager], and the PM is not well equipped to handle it.

Mrs. DAVIS. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Forbes.

Mr. FORBES. Mr. Chairman, first of all, I want to thank you for your work in this area. You have done a lot to move this forward and this hearing is one of those things.

And our committee is always—we spend some time in the weeds looking at the specificity of what we need to do and then we move up and get kind of an aerial view. There are times we need to do the aerial because it shows us the trajectory and the curve lines that we have.

When Eisenhower left office in 1961, he warned of the influence of a permanent armaments industry of vast proportions. But in the years of the Cold War, we have seen the size of our industrial base shrink along with defense spending. 1961 defense contractors comprised 15 of the top 100 companies in America and made 30 percent of those top 100 companies' total revenue. Today, there are

only 4 defense contractors in the top 100 and they make 4 percent of the total revenue.

Now, I know that is in part due to mergers and acquisitions and also tremendous growth in the commercial sector. But unfortunately for our national defense many of the commercial companies are hesitant to work with the DOD due to low profit margins, huge regulatory burdens, and demands that they turn over intellectual property.

Could you guys give us your opinion of the curve lines that you see that worry you about the industrial base and the acquisition process in terms of the health of our industrial base and its ability to meet the needs of our military, and also the flexibility that we might have. You know, we all talk about often in World War II how we could shift our manufacturing and produce other things. What worries you today about those curve lines, and is there anything we can do as a Congress to impact the curve lines?

Mr. Hunter, do you mind giving us your thoughts.

Mr. HUNTER. Yes. I would say if you step back and take the total aerial view, on the whole I would say the industrial base is actually still pretty healthy today. Where I get concerned is where that defense industrial base becomes very much divorced from the commercial side. And an example I would give is shipbuilding, right. The commercial shipbuilding industry in this country is gone essentially. There is a little sliver of it left out in California, but by and large it is gone.

And so all of the shipbuilding, all of the expense, all of the overhead of what is an expensive industry is carried by the Department of Defense. And that is why the Navy works so assiduously to try and take care of that industrial base which is certainly an excellent thing that the Navy does. On the aviation side, it has been much more tightly integrated both in terms of airframes and engines.

Now, that may also be starting to separate a bit, and so I do have some concerns that if the aviation side of the industrial base goes in the direction that shipbuilding has gone and we get this separation between the commercial aviation industrial base and the defense aviation industrial base, that could have real consequences. The decision by the United Technologies to sell Sikorsky does raise some concerns in that area. And that was not because the business was going away; it was more a decision about profitability. But that is a concern.

Mr. FORBES. Anybody else have a thought?

Dr. CHU. Sir, what I would worry about most is the lack of competition, the consolidation that you mentioned. You look at history of fighter aircraft since World War II in the early decades, I think the historians would argue the interesting innovations came from the firms that lost the last competition because they realized if they didn't come up with a new idea they would not be around much longer. That is no longer a threat to the major suppliers.

Coupled with, as you hinted, and as Mr. Pasqua's testimony underscored, a set of Federal procurement rules make it very difficult for a truly commercial firm to do business with a fellow company. So what you have is basically a firm that specialized in defense procurement or subsets of firms, such as the Boeing division between military and civil aviation that specialize in defense pro-

curement. And again that limits the degree of competition, most importantly competition about new ideas.

Mr. FORBES. Okay. Any other thoughts?

Mr. FRANCIS. Mr. Forbes, I think obviously competition is a big issue. And so as there has been contraction, there has been less competition, and I think we have come through an era of really big platforms which made winners and losers out of industry. So if you didn't get on the next new platform, you were out of business. I think we are a little past that right now and so there is not as much big, new platforms coming. So I have some hope.

I think the other thing is, there are barriers, I think, that can be reduced for the government to attract more innovative commercial firms to do business. That may be kind of limited. I think the government also has to instead adapt to the fact that the private sector is funding so much more research and development. So the government has got to learn to adapt to that.

Mr. FORBES. And my time is up, but thank you, gentlemen.

I would yield back, Mr. Chairman.

The CHAIRMAN. Thank you.

Mr. Walz.

Mr. WALZ. Thank you, Mr. Chairman. And I too want to echo my thanks for you grabbing onto this issue we all know is critically important in working in. Thank you all for being here.

Just a couple questions, and I am interested amongst the different services and the performance amongst them because there appears to be a difference, if there is some lessons learned or if it is the nature of the service. This idea of breaches going through the cost ceiling's scheduled performance or whatever. I started looking at this.

While this pains me to say as a former soldier, the Army leads in this area with a 38 percent breach. I am kind of curious, from your perspectives, is this cultural? Is it the nature of it? Or what is at work there that would set them apart from the Air Force and the Navy?

Mr. FRANCIS. That is a tough question. I think the Army, you know, after the Big Five programs of the late 1970s and the early 1980s, has had a difficult time finding traction with aviation and its ground combat vehicles and came through a very difficult phase with the Future Combat Systems, where it was coming up with a completely different concept for fighting. And I think that was doomed by relying on technologies that simply weren't there and they just couldn't execute that.

I don't know that the Army is quite recovered from that. After the Future Combat Systems, which is predicated on fielding an array of 19-ton vehicles that could be airlifted, the next vehicle that the Army developed was the ground combat vehicle which was a 70-ton vehicle. So I think the Army has had some difficulty trying to identify just what it needs and how it wants to fight.

And when it decides on something it has been moving out a little bit too aggressively, trying to get it fast and discovers during the process that it is not a good concept. So I have seen that more with the Army than the other services.

Mr. WALZ. Yes, sir.

Mr. HUNTER. I would agree with that largely. I think that—and the essential point that—with the Army not having recovered from Future Combat System [FCS], I think the issue is that they don't have a consensus vision within the Army of what the next Army should look like. You know, the 1980s, they had the Big Five and that was a pretty consensus vision. And because there were five of them and within that there were a number of subsystems, it essentially—every part of the Army was winning or was getting something out of that approach. And since the collapse of FCS, there has been no similar vision for how to move forward.

Mr. WALZ. That lack of vision, is that what led to like Crusader? I always look at that, is that the problem with the acquisition process, or did we actually see a glimmer of hope that it was actually killed after a while? I am kind of curious on that. Is that just part of this culture, they are searching for the weapon system that didn't fit the battle that was coming?

Mr. HUNTER. I would say Crusader is an example of a case where there was a vision but it was not an affordable vision. And so that is another obviously possible failure mode is you can have a great vision but it tends, you know——

Mr. WALZ. So this is a leadership issue then, is the way you see it amongst the Army or at least vision-wise. It leads me into my next question about we included the service chiefs having a say in this in the NDAA. And again, this might be the chip on my shoulder or whatever, is it important to add those senior-enlisted people? I would say they are closer to the end user type of thing. Does that start to straighten this mission out, or is that a whole different discussion?

Mr. HUNTER. Well, where I see the strength of having the service chiefs more involved is their ability to bring all the elements of the game together, budgets, requirements, and acquisition. And I think there is a lot of power in that. And they are at the top of those pyramids. And so I think that is the real strength that they have to offer. They by and large don't bring to the table a lot of technical expertise to address some of these technical issues because that is not their training. It is not expected that they should have that. So I think on terms of the enlisted side, to the extent that the senior leadership there can, again, help to bring the aspects of the system together, that is a good thing.

Dr. CHU. If I may add, sir, I think on the end user front, the end users you may most want to encourage to say more are the combatant commanders. They are after all the one responsible forces—at whatever level, enlisted—officer. And they don't have too large a voice in the present system.

Mr. WALZ. Great. I appreciate that. And again thank you for helping us understand this. I think all of us here do recognize this is a critical issue. And at some point in time we are going to have to—and I think the chairman is right again on this: We would like to fix it all. That is not going to happen realistically, but these steps forward do make a difference. So thank you and I yield back.

The CHAIRMAN. Mr. Rogers.

Mr. ROGERS. Thank you, Mr. Chairman.

I will throw this out for whoever wants to swing at it. Do you believe there is a bias in DOD goods and services procurement

against public/private partnerships? For example, does it make sense for OMB [Office of Management and Budget] and CBO [Congressional Budget Office] to require 1-year scoring of the entire liability of a public/private partnership but not the same treatment for traditional goods and services government to contractor procurement? Dr. Chu.

Dr. CHU. This question of scoring multiyear buys, particularly if they have a lease-type structure, which is what you are describing, I think is one that has bedeviled the Department. Congress, to point to a positive example, offered a way out for privatized housing and special provisions.

And so on the one hand, I understand the source of the constraint, which is to avoid signing long-term leases and dodging the fiscal limits; on the other hand, I think it has proven injurious to some arrangements that might indeed be interesting, and I would look to some provision, perhaps modeled on the privatized housing authority that allows meritorious multiyear deals to go through.

Mr. ROGERS. Mr. Hunter.

Mr. HUNTER. I would just say, my point about financial flexibility is exactly aimed at what you are talking about, which is the tendency within the system to shut down innovative financial approach because of scoring issues or legal issues or other impediments that have been brought in over the years, usually because of a bad case that happened somewhere in time and then we foreclosed an entire range of options. And multiyear funding is certainly an aspect of that, acquiring material through services is something that can be very powerful but is very hard to do in the current system.

Mr. ROGERS. Yeah, and housing was the example I was going to go to. It has been a stellar success. And you know, we are going to own it at the end of this 50-year lease/purchase agreement. It has been a win-win. But we run into these same problems with our satellite access. We would like to have multiyear deals where we could get a lower rate, and we are locked into the 1-year scoring, which is just a killer for us.

And another area where I would like to see this done is I would like to take the same model that we use for housing to re-engine the B–52 bombers. We could pay for that, in my view, with the fuel savings, but we would get into the scoring issue again. So I am real interested in your thoughts about how to get around that.

Let me ask this: There are going to be some areas where it doesn't make sense to treat goods and services as a commercial item where DOD can afford to rely on the market to influence positive private sector decisions. Is the space launch one of these?

And as you know, we historically have a situation where Lockheed and Boeing were in the space launch business and couldn't make a profit, and decided to get out and we went, no, don't do that. You all get together and put together a partnership called ULA [United Launch Alliance], and we will feed you enough business to keep you alive. And now we are being attacked—or that model is being attacked, as you know.

And I am just wondering, can we rely on commercial enterprises for essential national security access to space? Anybody want to take a swing at that?

Mr. FRANCIS. So Mr. Rogers, I know when ULA was formed it was formed on the basis of they thought there was going to be a big commercial market. So what they were going to do for the Department they thought they were going to be able to adapt to the commercial market and that market did not materialize. So they became more dependent on DOD.

Now we have opened that up to commercial competition so we have commercial firms that are competing. We still have ULA, as one of the competitors now.

Mr. ROGERS. Well, we have got ULA for the moment.

Mr. FRANCIS. For the moment, right.

Mr. ROGERS. That may not be there by December 1. That is the whole point.

Mr. FRANCIS. Right. So I think it depends on how good these commercial offerings are. Can their rockets—right now at this point we are trying to see whether they can handle those payloads and be reliable. And will there be a commercial market. So if the government is the only customer, it is hard to imagine you can have all of these suppliers. So it is going to depend on, I think, largely on the commercial market, and the government is going to have to protect its interest going forward.

Mr. ROGERS. The last statement you made is the key: "The government has to protect its interest." We have to, from a national security standpoint, have assured access to space, which by DOD definition means two sources. We are going to be doing good to keep one at the rate things are going.

But let me ask you this: Mr. Francis, you have recommended that, quote, "stronger and more uniform incentives are needed to encourage the development of technologies in the right environment to reduce the cost of later changes, and encourage the technology and acquisition in communities to work more closely together to deliver the right technologies at the right time," closed quote.

You point out that there are organizational, budgetary, and process impediments which make it difficult to bring technologies from DOD science and technology enterprise into acquisition programs. What are the impediments and how can we change this?

Mr. FRANCIS. So one thing is the science and technology [S&T] budget is relatively fixed. I think if you look over the past 20 years, it is about 20 percent of the R&D [research and development] budget. I don't know if that is the right number, but again, it is a fixed level of funding. Seems to me, if we are going to get ready for a next generation of something that maybe that S&T budget needs to be built up.

It is not big enough now to carry technologies far enough into maturity, so you end up having to hand them over to weapons system programs too early because they are the big bank for money. And there aren't really good mechanisms, at least consistent mechanisms right now, for science and technology managers to go into a transitional phase where they can work with program offices and successfully hand off technologies to those programs.

So I think there is some structural issues. There is funding, organizational, and then the fact that really it is the acquisition pro-

grams that are more in control of transition than science and technology organizations, which is different from the private sector.

Mr. ROGERS. Thank you. I yield back.

The CHAIRMAN. Mr. O'Rourke.

Mr. O'ROURKE. Mr. Francis, I was very interested by your comments about opportunity costs and that when we have cost and time overruns, it is not just money and time in an absolute sense; it is the loss of something else that we could have been focusing on, spending dollars on, spending time on. I know it is hard to quantify a negative, but do you have any examples of what some of those opportunity costs were, specific programs?

Mr. FRANCIS. There are some cases where the tradeoffs were explicit, so I remember, kind of using a reverse example, when the Comanche helicopter was cancelled, it freed up money which this committee, I think, took the lead on making sure that that money went into other Army aviation investments. So that is kind of using the negative to illustrate what should happen.

I don't really have good examples for when a program overruns and you need more money to do it and where did that money come from? So programs like the F–22, the Joint Strike Fighter, the *Ford*-class aircraft carrier that have overrun, we have made decisions to put more money into those to buy what we thought we were already buying, but I am not aware of where we have listed the tradeoffs. What did we give up to provide that extra money? Now, I have to believe that exists in the Pentagon, but I don't know if that is a debate that the Congress is afforded.

Mr. O'ROURKE. You also talked about the fact that we unintentionally incentivized, overpromising on the outcomes and underestimating on the costs, and you suggested that this committee or Congress should send a signal by rejecting some of these programs or projects or systems. Do you have any specific examples?

Mr. FRANCIS. You know, I was thinking about that before I came in. I really can't think of examples where Congress said no. What Congress tends to do——

Mr. O'ROURKE. Could you think of some examples where Congress should have said no?

Mr. FRANCIS. Oh, yes. So Future Combat Systems. I give this committee a lot of credit for having all the early hearings on Future Combat Systems. It was simply not possible. It didn't measure up to any reasonable test of an executable program. It relied on 50 uninvented technologies, and it was a $200 billion program, and we were going to do it, I think it was 19 separate programs, and were going to run all 19 in 5 years, in less time than it takes to run one program. It just was not executable.

What Congress tends to do and what it did in this case was it puts strings on the money. It will put a cap. It will put a condition that you can't go forward unless you report back. But it never said no to the program, so it took Robert Gates to say no to it. So Congress is reluctant to give a no. It will give an angry yes, but that is a yes nonetheless.

Mr. O'ROURKE. Let me ask you about another topic that you brought up, which is the need to take risks earlier in the cycle or in the process. Can you expand on that a little bit and talk about our role in doing that or in creating the incentives for that?

Mr. FRANCIS. Sure. And Dr. Chu, his statement covers that as well. We need to take risks. So we don't want a situation where we don't take any risks and we never have any failures. You have to take risks. We are not going to have perfection here. Perfection I think would be a bad thing, but we can do better. We need to take those risks in science and technology. That provides the environment where failure is okay.

So the purpose of S&T is to discover. But once you get into product development, the purpose of product development is to deliver, and you can't invent on a schedule. So I would say we have to take those risks in science and technology and carry those risks further and resolve them. And if we can't, then we make an eyes-open decision that we are not going to take the risks in product development, and so we are going to take those out of the requirements; or we are going to take the risks but we are going to have to put the money up to take them.

So too often we say we are going to take these risks, but we have a risk mitigation plan in place that is going to make it okay. But that risk mitigation plan generally lacks two things, time and money, which are the consequences most likely to attend risk.

Mr. O'ROURKE. Thank you. Mr. Chairman, I yield back.

Mr. HUNTER. Can I just add one thing to that? And I agree with what Paul has said, but there still needs to be path for that S&T to get into the arsenal. And that is where I would again mention this idea of adaptable systems, so when you do prove something out in the S&T or early stage R&D, you need a way to host it on a platform that the warfighter actually uses, so you have to make that connection.

Mr. O'ROURKE. Thanks.

The CHAIRMAN. Mr. Wittman.

Mr. WITTMAN. Thank you, Mr. Chairman. Gentlemen, thank you for joining us today. I want to talk about how things happen within the decisionmaking process on acquisition, and you pointed out some success models at the smaller scale where you can take a concept that comes from unit commanders. You develop that process of developing that idea with systems engineers, and you have program managers involved and contracting officers, and you end up with something that works and resembles what was needed at the very beginning. So that small-scale process you have shown works.

Let me ask this. How do we take that and graduate it to the large scale? How do we take emerging technology, compress the time process, be able to make sure that we have great communications from the unit commanders, to the systems engineers, to the program managers, to the contracting professionals, and getting that done?

It seems like to me today what we have is we have the unit commanders that are here, and then in a whole separate element there is the systems engineers that take that concept and develop it, and then in a separate place, in another area, are the folks that write the requirements, and then another group of folks that come up with the proposals and another group of folks that come up with the contracting process, so all of this is fragmented, and no wonder decision making goes awry, especially when it seems to be process-driven. People seem to be I got to check the box. And if I check the

box, then I have done my job. Instead of saying, you know, let's focus on what the warfighter needs. Let's focus on getting that technology to them as quickly as we can. How do we do that?

How do we put authority into the hands of those people at every point in the process? How do we bring the decision making together? And how do we make sure that we also have accountability there so we don't go awry, or if we do go awry, we can either get things back on track or stop things immediately? Give me your perspective on how we make those things happen.

Mr. HUNTER. I try to address this in my testimony. I talked about the importance of senior leadership and shortening the lines of authority for acquisition. And the model that I would offer is what we used for rapid acquisition was the Warfighter Senior Integration Group. And if you could picture it, a giant room, tons of people around a table. You have got the acquisition folks there. You have got the logistics and sustainment folks there. You have got the operators in theatre coming in through VTC [video teleconferencing] who are actually setting the requirements, are going to use the equipment.

Everyone around the table, with the Deputy Secretary of Defense there, and the question is not a debate about should we or shouldn't we. We are going to do it. That is the bottom line. And everyone who has a role in the system is there, and a decision is made. The Deputy Secretary says, here is how we are going to do it. Everyone go out. These are the marching orders.

Mr. WITTMAN. Mr. Hunter, I agree. That is a great concept, but that happens occasionally. How do we make that the rule? How do we make sure that that is how the acquisition process takes place, rather than saying here is a great example about how it works? To me it has to become a culture within the organization to make that happen. What needs to take place to make sure that that is the rule?

Mr. HUNTER. I would say for programs where faster is your priority, you can make that similar construct work. I believe that will be the case for the LRSB [Long Range Strike Bomber] program because you have this Rapid Capabilities Office in the Air Force that already works this way. It has a board of directors, very similar to what we had at the Warfighter Senior Integration Group.

Where you have instead of 50 layers between the person in charge, Deputy Secretary of Defense or in this case Secretary of the Air Force and the Under Secretary for Acquisition, it is three or four layers or less. To me that is where the real power of that approach comes. And it can be done. Now can we do it for every acquisition program in the Department? Probably not.

Mr. WITTMAN. Is this a directive that needs to come from the House Armed Services Committee? Is it something that needs to come through OSD [Office of the Secretary of Defense]? How do we operationalize this? Because we have got a lot of great ideas floating around about how to fix the acquisition process, but the ideas never seem to make their way to reality. Tell me where you believe the push needs to come from and the determination and concrete direction needs to come from to make this happen?

Mr. HUNTER. Well I would say Congress has done one thing in this most recent NDAA—the one that is still pending, I should say,

after the veto—is to streamline the process. So, you know, there are a number of documentation, check-the-box kind of exercises that have been imposed over the years, a number of them by the Department but a number also by statute and kind of cleaning the books of a lot of these things can really help.

And then, as I mentioned in my testimony, now that many of those statutes have been changed, making sure that the Department follows through to actually change the regulations because a lot of these things were required by statute. Now they are in the regs, and so you have to clean that stuff off the books. And following through to make sure that now that the statute has been streamlined, that the regulations are also streamlined is critical.

Mr. WITTMAN. Thank you, Mr. Chairman. I yield back.

The CHAIRMAN. Thank you. Mr. Moulton.

Mr. MOULTON. Thank you, Mr. Chairman. Gentlemen, thank you for being here. I just want to echo the chairman's comments that he began with, which were that I think that this is partly about conserving taxpayer dollars, which we know is incredibly important, especially in this budgetary environment, but even more importantly it is about responding to the next threats.

And you know, companies used to succeed in the light bulb industry by trying to be most efficient at making the light bulb for the least cost, and now companies succeed in that industry by being the quickest to develop the newest type of light bulb, to be the quickest into LED [light-emitting diode] technology. I think in my long tenure of almost 11 months on the committee, I have been a strong advocate of cutting programs that we don't need and old systems and legacy systems so that we can invest that money in the new ones, which I think is incredibly important.

One of the things that we need to do more of, as you have said, is be willing to accept the fact that technology development does not just occur in the Department of Defense anymore. It occurs outside. And there seems to be a conflict between the desire to get more commercial-off-the-shelf technology, and the MIL [military] standard requirements that this technology then has to meet.

And I think about how much more effective I would have been as an infantry officer on the battlefield if I could have used an iPhone. Now, if I were to get killed because my iPhone didn't meet that 100 percent requirement and failed at some point, there would be a lot of grief. But on the other hand, if we don't allow the iPhone on the battlefield for years because it can't meet that 100 percent requirement, a lot of people are going to die. And you might not see the news stories about it, but it will be a loss as well. So how do you think about better managing that conflict?

Mr. PASQUA. I think that is incredibly important, and to the earlier point about sort of what worries us in the larger curves, it worries me that some of the best minds of a generation in the tech world are focused on how to get you to click on more ads rather than technology that can be helping our Armed Forces. And I think one of the big reasons for that, as I mentioned in my opening statement, is it is just too hard. Companies don't know the terminology that is being used in this room. They don't know how to engage in government processes or DOD processes. They look at what it

would take to learn, and unless they are making a technology that is specifically suited for that area, they are just not going to do it.

Mr. MOULTON. So what can we do to try to fix that? I visited a company in my district that is developing an iPhone-based application or mobile-phone based application. And just out of curiosity I asked them why they had switched from the iPhone to the Android phone. And they said, well, the problem is it is harder to access the software on an iPhone. And I said ironically that sounds like a really good thing if you are in the Department of Defense, but obviously DOD does not have a good relationship with Apple; so in this case it might be harder to hack into an iPhone, but we are going with Android, and it is nothing against Android, but if that is true based on what they implied, it seems like a better partnership with Silicon Valley would help. What can we do to facilitate that?

Mr. PASQUA. I think there is a couple of things. I think one of the things that would be really helpful, and it has been happening. We are getting many more visits from different governmental organizations to the Valley to make companies more aware of what the opportunities are and how they might get more involved. But there needs to be, you know, short of changing all the acquisition processes, there needs to be some methodology, some help for these organizations to be able to sell into the Department without having to learn all of the processes that are involved because they are just not going to do it.

So whether it is working with larger integrators who already know the ropes so to speak, or creating conduits by which some of these technologies can get embedded into other modular platforms, as we have been discussing, more easily, I think either of those approaches would do it.

Mr. MOULTON. I just have 30 seconds. Dr. Chu, did you have a comment?

Dr. CHU. I think in terms of getting other firms to be willing to offer to the Department, what does need to be thought about is do we need to burden the contractors with as many special provisions, largely social goals, as current acquisition statutes require? It makes it very difficult for the commercial firm to want to offer to DOD. This is a high wall of expertise and requirements we are going to have to meet.

Mr. MOULTON. Thank you.

Mr. HUNTER. I just had one thought there. Other transaction authority, something that the pending NDAA would make permanent, is a way to do this to create a special, much stripped-down agreement with commercial companies. It is definitely a great tool, and it is something the Department needs to use more.

Mr. MOULTON. Thank you. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Mr. Scott.

Mr. SCOTT. Thank you, Mr. Chairman. And I think the question of is perfection the enemy, is good enough to get the job done, is something that we all wrestle with. And I also wrestle with, for example, cancelling the F–22 line before another plane is ready to go. I don't think that General Electric or any manufacturer in the world would stop one line of refrigerators before they had another line that had proven that it was capable of doing so.

I want to talk with you a little bit about the rapid acquisition process and the JSTARS [Joint Surveillance Target Attack Radar System], that E–8 platform flies out of Robbins Air Force Base. We have discussed for a long time the rapid acquisition process. And this is effectively a platform where the technology is ready to go. It is just a matter of getting the go-ahead if you will and the decision from the Department of Defense with regard to which platform they want to go with, and we are going to end up with an operational capability gap because of the depot maintenance that is going to be required on that platform, and there is not a battle management platform that can take its place going forward.

So, just if you could speak to why is there the delay when the Air Force knows what it wants, when they know the rapid acquisition process would save money, they know they have to field a new fleet, and the delay is actually going to result in an operational capability gap of a couple of years before full operational capability comes back, what factors contribute to programs being lengthened, even when they have those high levels of technological readiness for the major systems and subsystems?

Mr. HUNTER. My perspective on the JSTAR's recap program is, it gets back to this question of vision. I think the Air Force's vision for that program as a battle management control asset is something that the broader Department is still waiting to embrace, maybe would be the way to put it. Other services have thought traditionally—I think the Army has thought traditionally—of JSTARs as more of an ISR-type [intelligence, surveillance and reconnaissance] asset, so these are slightly different missions that the services see coming from this platform.

And if you think of it as an ISR asset, you say, well, we have got lots of ISR assets, and we have got unmanned ISR assets, and so why is a manned platform the right way to go? The Air Force sees JSTARs fundamentally as something bigger than or more than an ISR asset. And I think that is kind of the dialogue that has been going on. And they are making kind of that first step, and I mentioned in my testimony that Paul mentioned about the milestone B decision, which is a threshold decision of do we want to invest in this or not?

And you want to be cautious making that decision, but once you have made it, and you have made a good decision hopefully, then I think the priority is to proceed with all speed into program execution. And that is where I think JSTAR's recap would be a good example of something that ought to be one of these adaptable programs that I mentioned, particularly given the pace of evolution of electronics technology, that you want to have a design for that system that you can upgrade continuously throughout its life cycle because you know the technology is going to be light years away in 30 years in ways that we could never imagine today.

Mr. SCOTT. Well, we already have some of that. We have the ability to plug and play, if you will, with certain camera systems and other things, and with respect as far as the Army, you said waiting to embrace, that is not my understanding from the Army. That platform flies continuously and has for approximately 20 years. We have got a problem with corrosion now. I mean, these planes are old. These are 707s, I think, from the 1970s that we

have updated and updated and updated; and to send these units through another major round of depot maintenance, it would make much more sense to spend the money on totally new systems.

Mr. HUNTER. And I agree with that, sir. I am not in any way suggesting we shouldn't move forward on the program. I think this dialogue that has been going on as they have gone to this investment decision has been more about the vision than it has been about the specifics of the program.

Mr. SCOTT. What about just the example of shutting down, for example, the C–17 line without another lift capability ready to go? I am out of time. I apologize. I yield.

The CHAIRMAN. Interesting questions. Mr. Castro.

Mr. CASTRO. Thanks, Chairman. I know that we talked about the competitiveness of the process in contracting and how it has become dominated over the years by a smaller group of companies. Some of that is due to consolidation. We also talked about how hard it is for commercial enterprises to break into defense work.

So I guess let me ask you, we also have in front of us information on the cost overruns and breaches for each of the divisions. Is there any penalty for a contractor who experiences a cost overrun on a contract? Or I should ask what is the penalty?

Dr. CHU. Depends on the contract. If you have a cost-showing provision or if it is a fixed-price situation of some kind, the contractor will obviously earn a lower rate of return. I think the ultimate penalty for the contractor is something Mr. Francis touched on, which is, if the system proves more expensive, the Department may decide to buy fewer of those systems. And so the length of the production run or the volume of business the contractor enjoys is thereby diminished.

In the worst case, the Department will decide, has occasionally done so, this is too much. We are going to stop and thereby lose the opportunity to further production. So any contractors have an incentive to try to keep, not necessarily to meet the guidelines that were pledged in the acquisition process—that is a whole different issue—but to keep the production price of the article still competitive with the mission need.

The real issue in all these cases is, is this worth investing in to perform the mission we have in mind, or has it become too expensive relative to the return that it will yield?

Mr. CASTRO. And is it fair to say that over the years particular contractors have again and again gone over on cost?

Dr. CHU. Since we now have a small number, I don't think any of them has been exempt from that problem. I think it is important to keep the cost overrun issue in perspective. The large cost overruns are largely percentagewise on development contracts, not production contracts. Once we get to production beyond the first few lots, we generally have a fairly good idea what it is going to cost, and people stay within those parameters.

The typical program doesn't actually overrun. That is not always true. That is the legend out there that they all overrun. That is not fair——

Mr. CASTRO. Let me ask you this. We have been speaking about each contract individually. Is a contractor who consistently overruns penalized when they bid for a new contract? In other words,

with consumers, for example, many of us are subject to credit scores; right? So if we demonstrate bad credit over a period of time, there is a penalty when you try to get credit next time. Does the same principle apply with contracting here?

Mr. HUNTER. Well, I would say it does to an extent. There is two ways in which it can apply. One is past performance. Rarely are major contractors ruled out because of past performance, so there I would say no. On the other hand——

Mr. CASTRO. Are they not ruled out because there are simply not enough options that we have? In other words, is there such a limited number of these contractors that you just can't go anywhere else?

Mr. HUNTER. It could preclude competition if we ruled out a major competitor, but what they do often in the evaluation process is they will evaluate the contractor's price, not necessarily exactly at what they bid it, but at what the estimators inside the government think that that would really translate to. In other words, for example, with the tanker contract, the last version of that was fixed price, so it was evaluated at what was bid.

But a previous version, they evaluated the price of the bidders higher because they thought, we don't really believe the costs that you are putting forward. And so depending again on the nature of the contract, they can evaluate a contractor at a higher price if there is a history that they have delivered at a higher price.

Mr. FRANCIS. If I may, it can get pretty complicated, so an overrun, you get into a debate as to whose fault it is. Did the contractor deliberately underbid and then overrun, or did the government underestimate and——

Mr. CASTRO. Well, but is it safe to say, that the Department of Defense has the most overruns, and the cost is the highest of any of the agencies of the Federal Government? You are part of the GAO, so I assume——

Mr. FRANCIS. Right. Actually as much as we talk about the Department of Defense, they are probably the best in acquisition. If you go to the civilian agencies, they are much worse generally.

Mr. CASTRO. So there are more overruns and more breaches?

Mr. FRANCIS. A much higher percent, yes. This is probably the subject of another hearing, but the government and the contractors don't share the same interests. I mean, they are working together on a program, but where the government may be thinking it has got a contract to get a product for a certain price, where the contractor maximizes its profit. The contractor is also interested in a longer business line, keeping its facilities amortized and so forth, so they may sacrifice profit to get a larger volume of business, so two different incentives here.

Mr. CASTRO. Thanks. My time is up. I yield back, Mr. Chairman.

The CHAIRMAN. Thank you. Ms. Stefanik.

Ms. STEFANIK. Thank you, Mr. Chairman. Over the course of the war in Afghanistan, we saw ground combat vehicles undergo a number of upgrades and additions because of new and increasing threats. But specifically in the Army, protecting the safety of our soldiers also added additional weight of combat vehicles, and, therefore, we had subsequent challenges to maneuverability and rapid deployability.

I represent the Army's 10th Mountain Division, and lightweight weapons systems, body armor, and operational mobility are essential capabilities for the 10th Mountain. So the struggle as I see it is how do you balance the weight against the protection, against the budget? So for example, obviously a vehicle built out of titanium would address the weight challenges, but the cost would be much greater.

So how can we as Congress help the DOD make those needed upgrades or obtain new and affordable materials which are able to stop emerging threats?

Dr. CHU. I think your question goes exactly to the thought I offered, that a more physics-based approach at the early stage of the program, looking at these tradeoffs explicitly, would be very helpful. And if Congress were to ask for what the parameter space looks like, which it doesn't tend to do, in other words if we want more protection, what are we going to sacrifice either in carrying capacity of the vehicle, or cost in order to use a more advanced technology for protection, that would lead to a more informed debate about why did the Department pick the particular combination of ingredients it is recommending in the program that is going forward? That conversation at the legislative level typically does not happen now.

Mr. HUNTER. I would say, you bring up a point that I think starts to highlight some of the challenges that the Army has in moving forward with its acquisition programs and its vision. Because I know that the Army has looked at what can we do with combat vehicles.

And one of the reasons why I would suggest and that I have heard from some in the Army acquisitions system is that they aren't moving forward on a new ground combat vehicle is because they don't think they can get one that is significantly lighter than the systems they have today. And there is some logic or some mode of thought that says why would I invest billions of dollars in a system that ultimately isn't going to meet the objective I want, which is a lighter, more maneuverable vehicle?

This also relates to the point Dr. Chu made about the MRAPs and why the government didn't retain most of those. We did retain some, and actually many of the ones that were retained are the M–ATVs [MRAP All-Terrain Vehicles] that were maintained in Afghanistan which were more mobile and able to move around in more challenging terrain. But the heavier versions that we used in Iraq have largely been let go because they don't meet that priority.

Mr. PASQUA. Just a quick comment. I agree with Dr. Chu's comment about understanding and explicitly choosing the point in the trade space early on in the process and understanding what the entire space looks like. I would just add that it is important also to get a feel for what it will take to make a move in that space. So we can understand where we can be at a given point in time, the tradeoffs that we are making to choose that point, and understand what it will take if we want to move in other directions, or at least have a feel of the scope of it.

So that is to say that, you know, we talked about modular and adaptable systems, but they are not free. They are actually hard. It is hard to design a system that is adaptable in every conceivable

way; and, in fact, you typically don't want to do that because it will introduce new limitations or costs. But it is important to understand, even when making the initial choice, what the costs will be to make moves to different areas in the trade space like lighter weight, what the costs would be associated with that, and in the upfront design decide whether it is appropriate to enable those moves in the trade space later. Because as I say, it will take costs to enable that modularity or flexibility.

Dr. CHU. If I may add one thought, as one looks at the technical trades, I think it is always important to keep in mind what mission need are you trying to fulfill? And that may lead to you conclude that you don't need quite as technologically ambitious an article as you thought you did.

An example comes to mind on position navigation precision, one of the technical programs I have had a chance to look at. When we were aiming at a very high degree of precision, when we showed operators, back a bit to what Mr. Hunter was emphasizing, what we could achieve, which was far south of that objective, they said, no, no, that is good enough. Don't keep going. We will take what you have already been able to achieve.

Ms. STEFANIK. Thank you. Mr. Francis, do you have anything to add?

Mr. FRANCIS. Yes. I think a good example of what you are describing is what Secretary Gates brought up, so when the Army was really putting all of its emphasis on the Future Combat Systems for the next war, Secretary Gates made the point that we are not really focusing on the war that we are engaged right now.

And I think the issue becomes in some cases we are not anticipating well. So the science and technology community was not necessarily working on those up-armoring solutions. So, when the need arises, we have to react, and we have to react maybe suboptimally, so anticipation is important.

Ms. STEFANIK. Thank you, my time is expired. I yield back.

The CHAIRMAN. Ms. Speier.

Ms. SPEIER. Thank you, Mr. Chairman. Thank you to our experts who are here today. You know it has been said that we have the best weapons in the world, but our acquisition pipeline often gets us those weapons late and over budget.

Mr. Francis, you have said that to describe our acquisition process as broken is an oversimplification because it implies that it can merely be fixed. Time and time again we have tried to overhaul this process. We come up with the same challenges, an ingrained culture, an inadequately trained workforce, an inexperienced set of program managers, and a dangerous revolving door to industry.

In March of 2015, the GAO issued a report that 19 of the 38 assessed programs reported they planned to begin production prior to completing software development needed for baseline capabilities. A perfect example is the F–35, where software for even basic capabilities necessary for testing and evaluation are running months behind. As weapons systems grow in complexity, this is a problem that will come up more often than before.

How can we adjust our acquisitions process to better develop and test the software components of the hardware? And that question is open to any of you.

Mr. FRANCIS. So, Ms. Speier, I think one of the issues there is not fully understanding what the requirements require from the design. And that is something we have had conversations with the chiefs about. They think they understand the general requirements, but they don't understand the thousands of specifications that are necessary to meet those requirements. And a lot of that translates into software code.

And I am trying to remember on the JSF [Joint Strike Fighter], and maybe one of of my colleagues here can help me, but I think it is like 80 percent of JSF's functionality comes from software. I don't know that that is known in the beginning. And that is what, when I talked earlier about we need to know what the design requires and what risks we are taking upfront and we can make decisions on that.

Rather what tends to happen is we don't know enough when we start. These risks get played out later on, and we end up with what I call latent concurrencies, doing things at the same time that we didn't plan on doing at the same time. So if we are going to be concurrent, let's agree to it upfront and say we are taking that risk. If we don't want to be concurrent, then we have to understand the design better sooner.

Ms. SPEIER. Mr. Francis, you were here almost exactly 2 years ago on October 29, and I am sure you feel like a broken record, but on the theme of repeating yourself today, you mentioned the *Ford*-class aircraft carrier in your testimony. Saying that the GAO identified this program as lacking a good business case back in 2007. That makes the program's current struggles unfortunate but not at all unsurprising.

What programs are currently in the pipeline that we should be looking at with greater scrutiny? What aren't we looking at today that you will be talking about in 2 years?

Mr. FRANCIS. So I will come back for the record with a list, but I think the Joint Light Tactical Vehicle, the Army program, is something that needs to be looked at. Long Range Strike, when that program comes up, that needs to be looked at. *Ohio*-class replacement is another big one coming. DDG–51 Flight III right off the top of my head are big ones that I would think about.

And I think for Congress, where you really have to weigh in is, when money is being requested for these, so their milestone B decisions might be 2017 or so, but you have to ask those hard questions now when you are putting money on the table. So I will come back with another list, but perhaps some of my panel members here know about other new programs coming, or maybe not.

[The information referred to can be found in the Appendix on page 117.]

Mr. HUNTER. There is a few others. We mentioned JSTAR's capitalization program which is right on the cusp of entering the process, and another one that has been a big focus has been U-class program.

And I assume when Paul says take a look at them, that doesn't mean cancel all those programs. I am not, certainly, going to put myself in that position. But I do think the role of the Congress in examining that investment decision that the Department has

made, to say "Why is the cost of this worth it from a warfighting perspective?" is absolutely the right question to ask.

And asking it right around the time of milestone B, I would say ask it around the time of milestone B. Paul is saying ask it a little earlier than that even. You want to be on the front end. Once you get deep into the program, there are constituencies associated with it, and frankly, you are committed in a way that is just hard to get out of. And that is why those early milestones are so critical.

Ms. SPEIER. Thank you. I yield back.

The CHAIRMAN. Ranking member.

Mr. SMITH. Just following up on that, you talked about all those programs that have been to be, quote, "looked at." Obviously, they have to be looked at. They are going to cost us billions of dollars. You are planning on building them. Looked at, A, from the standpoint of do we even need it? Is that is what you are saying? I mean, if you could be specific because, I mean, you rattled off basically all of the major programs that we are planning on building over the course of the next decade or so.

And you know, *Ohio* class, Long Range Strike, JLTV [Joint Light Tactical Vehicle], are there any of those that you would say from a warfighting standpoint, why are we building this? We don't really need it. That is one. And then two, are we making some of the same mistakes with those programs that we made with the F–35, basically constructing the plane as it is working its way down the runway? And those are my two questions.

Mr. FRANCIS. So, what I was suggesting was more on, are these programs executable? Whether they are needed, and what are the right solutions? You know, I have to think the Department really does consider that pretty heavily. You do have to ask those questions, and I would ask, I think it is hard to say these programs aren't needed.

The real hard question is, do we need this program at the expense of this other one? What tradeoff are we making? Those are fair questions to ask. I don't have evidence to say these programs aren't needed. But I do think where you can really weigh in is, we have talked about things like technology maturity. Is the design understood? Do the requirements reflect reality, or are they too lost.

Mr. SMITH. And as you look at where we are at on those programs, can you point to a specific red flag? Because, I sort of get all that. That basically, you know, on these big-ticket programs now, you know, concurrency is—well, I can't say that word in a public hearing—but not a good idea.

Basically figure it out, then build it. Not at the same time. Do you see us making that same—are we counting on that level of, okay, we will build it and then we will figure it out as we go? The *Ohio*-class is an enormously expensive program. I think it is probably the most expensive one of the bunch. Are we making that mistake in these early stages in your view?

Mr. FRANCIS. So we haven't yet looked at *Ohio* class, or JLTV, or Long Range Strike. We are looking at Long Range Strike, but that is classified so we can maybe give you some information on that. So I don't have anything specific to offer there. On DDG–51

Flight III that is moving very fast. That is really rapid acquisition. We do have——

Mr. SMITH. Is that a good thing?

Mr. FRANCIS. Pardon me?

Mr. SMITH. Is that a good thing?

Mr. FRANCIS. I think in this case it is going a little faster than it should. It has been bundled into the multiyear for the DDG–51 Flight IIA.

Mr. SMITH. But isn't the real issue here just the rapid pace of technology? You know, I mean, we can all just sort of logically say, as I facetiously said, don't build the airplane as it is working its way down the runway. You know, figure out what you are going to do, and then do it.

But the problem is, while you are building these things, technology is just boom, boom, boom, boom, boom, moving. I mean, it is Moore's law. You know, how do you get around the problem that if you take the opposite approach and you say, look, we are going understand it, and then we are going to build it. And we are not going to change it.

Because really what drives a lot of these costs, well, on the *Ford,* is change orders; is as we start building it we go, you know what, now we could do this. Let's do that. Let's add that to it. I mean, Huntington Ingalls will tell you that if they were building the same aircraft carrier that they were told to build when the contract was given to them, it would be on budget. But there has been so many changes.

But I guess what I am asking is, part of those changes are driven by just the way the world works these days. Technology is updated. You can build a better thing. Would you say that we are better off to say, look, we know the technology is improved, but we are better off building good enough, than trying to adjust to that technological improvement that could make it better? Because isn't that what really traps us on these things, is the technology, you know, leaps ahead while we are in the process of building it?

Mr. FRANCIS. Well, two things, Mr. Smith. I think when you talk about enabling technologies, technologies that make that platform possible, so on the carriers it is the Electromagnetic Launch System; it is the Dual Band Radar, and it is the Advanced Arresting Gear.

If these are enabling technologies, you have to have them matured before you go forward with the concept because they make the concept possible. Going forward from that, you want to have open systems architecture so you can then bring in modular improvements of that baseline.

Mr. SMITH. Upgrade.

Mr. FRANCIS. That is right. So what is going on with the *Ford* class is not so much technology refresh as we go, it is technology discovery as we go.

Mr. SMITH. Right.

Mr. FRANCIS. So you have to have a two-pronged approach, I believe.

Mr. SMITH. Yeah. I mean, to a certain extent aren't we—I'm sorry, go ahead, Mr. Hunter.

Mr. HUNTER. Well, I was going to add to that, we have been having a discussion about adaptable systems. And I think to your point, an example that I used in my testimony is the Predator system, you know, which has really evolved. It is almost unrecognizable now as a system from where it was when it started. And in incremental changes along the way, it has adapted to warfighter needs.

And I think it is a classic example of how that can be done. You start with a relatively simple thing. It is an air truck. It happens to be an unmanned air truck, but other than that, it is basically an air truck. But it is a flexible enough design that as new sensors have come along, new weapons have come along, many, many changes, I probably shouldn't get into all of them that have been made——

Mr. SMITH. Right. In that case we were able to add it to the existing Predator. We weren't required to scrap the ones we had and build a whole bunch of new ones, is that correct? And I am sure, but——

Mr. HUNTER. Well, it is true in part, and untrue in part.

Mr. SMITH. Right.

Mr. HUNTER. So the design that we have today is significantly bigger than the original assets that were done. But it looks roughly the same. So the general design concept has been fairly constant, but it is a bigger airplane today than it was before.

Mr. SMITH. Yeah, but like on the *Ohio* class, I suspect that as we build that thing, there is going to be technological improvements that we are going to want to add to it. And I actually would suggest that we are better off not.

We are better off saying, look, we cannot afford to drive these costs through the ceiling, and yes, maybe it won't be absolutely perfect or as good as it could be, but particularly from a competitive standpoint. I think the *Ohio* class would be able to serve its function without adding all the new stuff that is going to be discovered in the next decade.

And I think that is a choice we need to make because it seems to me, we always make the other choice, which is, you know, this is my Austin Powers joke: All I want is sharks with frickin' laser beams attached to them. I use that joke frequently in acquisition, because, you know, it's like, we can do this. Let's try it. And we could, but the costs are prohibitive compared to the gain.

And I think we need to start accepting good enough instead of, we could put the laser beams on the sharks, so let's go ahead and give it a shot. But, you know, those are individual decisions that have to be made program by program by the program managers and by the Pentagon. I just hope they will start making the more cautious decision to save us some money.

Mr. HUNTER. *Ohio* class is an interesting example, because actually, you probably need less than the existing system we have today. I am not suggesting we scrap them, but——

Mr. SMITH. I am sorry, which system?

Mr. HUNTER. To the existing system we have today——

Mr. SMITH. Right.

Mr. HUNTER [continuing]. In the sense that we are going to fire the same missile——

Mr. SMITH. Right.

Mr. HUNTER [continuing]. And we don't necessarily need as many tubes as we have today. Our requirement is not as robust as it was when the *Ohio* class was designed. So, of course, we are 30, 40 years on, and so there is going to be new technology. There has to be new technology in the system because you can't go backwards——

Mr. SMITH. Right.

Mr. HUNTER [continuing]. On many of these things. The one last thing I would say in terms of submarines, is the Navy really pioneered this adaptable systems approach with the combat system on attack submarines, their Acoustic-Rapid COTS [commercial-off-the-shelf] Insertion Program. And I think that is exactly what you are describing, is, you know, go into production with a design that you know works, and then have a system that allows you to update and upgrade that combat system as technology proves out.

Mr. SMITH. Okay, thank you very much. Thank you, Mr. Chair.

The CHAIRMAN. Thank you. Ms. McSally.

Ms. MCSALLY. Thank you, Mr. Chairman. And thank the gentlemen. I spent 26 years in the Air Force, and I was lucky that I didn't get any assignments to the Pentagon. So my perspective comes from the warfighter end of that perspective.

We had a hearing earlier this year and my first question is about development of aircraft, not Joint Strike Fighter-type aircraft, but say, follow-on to the EC130, or follow-on to the A–10 for a light-attack aircraft.

In a hearing earlier this year, I asked the Pentagon official if we decided today that we wanted to develop a light-attack aircraft—again, this is not complicated technology. It is just all of the things that we have learned about what does permissive CAS [close air support] and does it well to follow on to the A–10, and we decided, today if we wanted to do it, how long would it take? And he said about 15 years, I think was his answer.

I look at the EC130. We know the guts of the EC130 is working. It has got a great mission set. We know it needs a new platform, but, you know, we struggle to take forever in order to figure out how to adapt what we have and put it in a new platform.

You know, what is it we can do specifically in like these types of things? We are not developing new stealth technology, fifth-generation fighter, but we are just learning from everything we have had, and we have just got to refresh and put it into maybe a different package. Like, why can't we do this faster? And what can we do to help especially in those two examples, you know, to be adaptive, to put these smart brains together, and develop something in 3 to 5 years that could be follow-ons to these type of platforms. Anybody want to jump in?

Mr. HUNTER. Well, I can't resist, having spent time doing rapid acquisition. We do do it faster. We have done it faster. This is something that I guess amazes me after my time in the Department that, you know, go to Iraq, go to Afghanistan——

Ms. MCSALLY. For an aircraft. Specifically for an aircraft.

Mr. HUNTER. Yeah. There are systems that are flying. Hosts that just simply didn't exist even 3 years ago.

Ms. MCSALLY. So why do they still say 15 years then? What are we missing?

Mr. HUNTER. So what that is an answer to is a fleet of aircraft that we are going to sustain for 50 years. It takes 15 years, essentially to—if you are lucky, to have a program that is going to be a 50-year, large aircraft fleet type of a system.

And there may be opportunities to accelerate that, but on the other hand if you think you are going to sustain something for 50 years, it probably makes sense to take a little extra time to get it exactly right. But we don't need to do that in all cases, and I think that is kind of the key.

Ms. MCSALLY. Yeah.

Dr. CHU. I am not sure I want to defend the 15-year estimate as being meritorious.

Ms. MCSALLY. Yeah.

Dr. CHU. Certainly, if you insist on starting every element of the new design over, you are going to add to the time scale. I think part of the genius, and it is hinted in the way you phrased the question, is can we take some existing designs—which might be foreign, by the way, not necessarily in the United States—and adapt those to whatever purpose we have mind. And I think a more—the approach that builds more on what we already know would allow you to field capabilities faster.

Mr. FRANCIS. So a couple thoughts. I have been around long enough to remember when the A–10 was being developed and the Air Force wasn't particularly in love with it either.

Ms. MCSALLY. Still isn't.

Mr. FRANCIS. So you have to want to do it. I think what Mr. Smith was saying is important. The 80 percent solution has to be okay.

Ms. MCSALLY. Right.

Mr. FRANCIS. And that is hard to sell because you have to show you can crush all the alternatives. So you need a 200 percent solution. Eighty percent has to be okay. The other thing we haven't talked about is there are cases where you want to put a time constraint on the development. So if you put time in there as a constraining factor and say, I want to get through the development phase in 4 years, what can I do then? That has a way of affecting the requirements of the design.

Ms. MCSALLY. Yeah. Great. Thanks. You know, my other experience with this is, I have spent a lot of time in air operation centers, and joint operation centers, and spiral development is something that we worked on in JEFX [Joint Expeditionary Force Experiment] programs and time-sensitive targeting.

And, boy, that seemed to work great, but as was mentioned earlier, that is not the norm. That is kind of a one-off where you have got the warfighter and the people who are developing the technology for command and control. Which is basically about collaboration, real-time decision quality information. This is not rocket science. I mean, this is just allowing the information to be collaborated for the exact type of mission that you are looking for and adapted, and that worked really well. But that is really not the norm.

You know, just basic geospatial information we were trying to develop in the Joint Operations Center at AFRICOM [U.S. Africa Command] and had that vision, but it just seemed like we were dealing at the speed of bureaucracy instead of broadband. And when it comes to some of these other issues with command and control, collaboration, information sharing, there is some great stuff that is, obviously, way out in front of us in the civilian world, in the private sector.

What do we need to do in order to very quickly bring that in to make sure that, you know, we are allowing our command and control system to not be bogged down? Because it was a quite painful experience that I went through in both the Air Operations Center, and the Joint Operations Center, just not being able to adapt quickly enough. And anybody want to jump in?

Mr. HUNTER. Well, I would say one thing is that there are real impediments in the system that make it very hard to do that. And we have talked a bit here about the agile approach to acquisition. And there is a real challenge to utilizing that approach, and I mentioned, I have talked about it as adaptable systems, which is the system is designed to say, give me a clear baseline, everything you are going to do, and then I will grade you as to whether you have met that baseline or not, or whether you have gone over. And if you have gone over, I am calling you for cost growth or schedule growth.

And there is, now, and I have said a lot of things that I like that are in the pending NDAA [National Defense Authorization Act]. There is one that I don't like, which is the provision that says, we are going to penalize the services year after year after year, if they experience any growth above baseline. Well, if you have got a fragile system, or adaptable system, of course, you are going to grow the baseline. That is the whole idea. That is the point.

But effectively, you know, this provision is going to make it so that the services, in order to do that, it is going to be like going over the salary cap for an NFL [National Football League] team or an NBA [National Basketball Association] team. They are going to have to pay a penalty every year because they are trying to do something to make the system better. And I think that there are many other barriers because it becomes very hard to baseline these programs where you know you are going to evolve them, but you don't know exactly how yet. So that is a real issue that we need to work through, and I talk in my testimony about we need to come up with a new paradigm, not for everything, but for some of these systems that we think we need to be highly adaptable.

Ms. MCSALLY. Yeah.

Mr. PASQUA. There is an approach in industry called MVP, for minimum viable product, and the whole idea there is, don't build the be-all, end-all. Don't boil the ocean. Build what is actually needed to accomplish whatever it is you are trying to accomplish. And build the minimum thing that is needed. Because, in fact, you are not going to know all the details of how it is going to grow and how you are going to want to adapt to use it.

So instead of trying to build the be-all, end-all, the goal is much more to build the smallest thing that meets the requirements with

the adaptability to go in different directions that you don't necessarily know today. And that has two sort of beneficial outcomes.

One is, it happens fast. It is small. It tends to focus you on what is really important rather than on contingencies that may be important some day. And it gets you to focus on the adaptability of the architecture that you are building, so that as you actually use it and find what is important, or your needs change, it is easier to actually take the system in the direction you want to go in a much more cost-effective way.

Ms. MCSALLY. Great. Thank you. Thank you, Mr. Chairman, I yield back.

The CHAIRMAN. Thank you. Mr. Langevin.

Mr. LANGEVIN. Thank you, Mr. Chairman. I want to thank our witnesses for your testimony and appearance here today. It has been a very interesting discussion, obviously.

So I serve as the ranking member on the Subcommittee on Emerging Threats and we oversee all of our R&D efforts, DARPA [Defense Advanced Research Projects Agency], and ONR [Office of Naval Research], and others. And just in S&T directly, you know, the basic nature of S&T development means that several failures often proceed as successful technology. DOD culture, and acquisition processes, and congressional oversight are often risk-averse at best, and punish failures at worst. How can this culture be changed or mitigated, or should it?

Mr. FRANCIS. Well, Mr. Langevin, I would say definitely making the investments in the science and technology community, and giving them the budgets to take things further, so I think you have to have a wide funnel in the front. I think you want to have a lot of failures early, and then as you are paying for more mature technologies and higher levels of demonstration, obviously, you have to be more discriminating there.

But the S&T community, I think, should have the organization and the resources to take those technologies further up and be okay with having those failures early. Right now, I think it is not so much that we are afraid of failures, but we put things that haven't reached the point of failure yet, and we put them in an acquisition program, and then we discover what the failures are.

So I don't have really a problem. We were talking earlier about the carrier. I don't have a problem with what those key technologies are going through. The problem I would have is, where they are going through them. It is right during construction of the ship. So those are the risks that we have to take earlier.

Dr. CHU. Indeed. I would agree that it is not clear to me it is a risk-averse culture. In fact, we take the wrong set of risks, I think is what Mr. Francis is arguing. And we underinvest in technology development, without—or let me put it the other way around—that too often we see technology development as always needing to lead to a new system, and that is not always going to be true.

I think more willingness to sort through the technological choices in an organized way and to reward people for giving good advice about which are the promising paths versus the ones that should be shut off. In the current incentive system, managers talk about

the value. Everybody thinks he has to get his or her technology into production. That is the sign of success.

Now, I would argue differently. Success is having a broad portfolio of choices to start with and narrowing down to the most promising ones. That does include, as Mr. Francis I think has emphasized to you, much more emphasis on developmental testing than has been true in the recent past.

Mr. HUNTER. One thing I would add in terms of risk is that we can do better at managing risk. So I would agree. I don't know that our system is unwilling to take risk, but it does struggle to manage risk. And in many cases, you know, you will see these risk charts, you know, and there is always one item that is either high yellow or red, and everything else is kind of green or in the mid-yellows, and they all look roughly the same. Because there, really, again, it is in some cases, unfortunately, more about selling the system than it is about managing the risk.

And that requires real discipline, and this is where the quality of the workforce comes in. So that the government workforce really understands what the risk is, and what is the plan to manage it, to burn it down over time. And I think the biggest key there is leadership and then the human capital issues that Dr. Chu has referred to.

Mr. LANGEVIN. A follow-up question. What changes are needed to allow for a rapidly changing investment area such as cybersecurity, which I spend a lot of time on, where generations of technologies can pass within a single budget cycle, and to what extent do current budgeting processes impede the deployment or development of technologies?

Mr. PASQUA. This was a particular frustration area for me. I ran the global research organization at Symantec, which is the largest cybersecurity firm in the industry. And one of the challenges that we had, given the rapid pace of change of the landscape, was that we develop new technologies in our research organization and want to get those out and into the hands of our government counterparts, but oftentimes the cycle of doing that, just being able to discuss it and go through the process, was so long that the window of opportunity for dealing with a threat had passed by the time that we were through it.

And I always wished that there was a way for us to build a relationship that didn't start and stop; that provided a way for us on an opportunistic basis to say, hey, we have got an interesting technology for you that we think is of interest for you to get into service today or very soon. How can we make that happen quickly and not have to start, you know, a whole cycle of discussions to make that process happen that then made the technology irrelevant 9 months later.

Mr. LANGEVIN. I know my time is expired, but that was an interesting question and response. I appreciate your thoughts. I yield back, Mr. Chairman.

The CHAIRMAN. I thank the gentleman. Mr. Cook.

Mr. COOK. Thank you, Mr. Chairman. I apologize. I had to meet some constituents, so I probably missed some of the responses to maybe some of the questions that I am going to ask right now. And one of the problems I have is just the, and I am speaking as some-

body that has been on the receiving end of some of these systems where they don't work, or they break down, or they just don't fit into the mission that you are supposed to have.

And I don't have the complex rocket ships and everything like that. I am talking about the M–16 when it first came out in Vietnam where a lot of Marines died because you had a lot of things wrong with it. And I actually had an opportunity to change it by talking to a guy by the name of Omar Bradley who had to be about 86 at the time where they dragged certain people from the field. That, the Gama Goat, the M–203, which was 5 years that I knew it was on deadline, never even saw it fired. I can go on, and on, and on.

And I don't know if we—and then I was just at a CODEL [congressional delegation] where somebody was asked a question about cybersecurity, and they said, we are just starting now. And in about 5 years, we are going to show it. We don't have 5 years. No one knows how long we are going to have with what is going on in this world right now.

So I think from somebody that is on the frontline, the troops, they want something right away, and something that fits their mission. And you can have a lot of different—but basically, it is to close with and destroy the enemy. And I am wondering if we launched that philosophy in World War II where we had certain systems that came out that didn't work, where almost within weeks, we had changed it. Unbelievable that we could do that.

And you look at what happens with the Sherman tanks in Normandy, where it was a field expedient by a sergeant that changed the whole thing, turned it into a Rhinoceros tank, changed the whole battlefield almost overnight. What did it cost, $15? And then they did it to all the tanks.

I can go on and on and on. But I think Congressman Walz had a good point. Sometimes I think the individual troops or what have you, the customer, the end recipient, the ones who have to live and die with this system—Iraq, when we had to upgrade our Humvees and the MRAP came down, great success, but in the interim X amount of people died or were wounded.

And I am just saying, to me, I think we have got to expedite that, and make it cost efficient and we have to put certain deadlines. And if it doesn't work, there has to be consequences. That is the bottom line. And some of these systems we can do it.

When we changed from the old bazooka to the 3.5 rocket launcher, sounds simple, but the bazooka was not able to penetrate the Russian tanks that were made; the 3.5 was. Now, 3.5 is long gone. They replaced it with the LAW [Light Anti-Tank Weapon], which was another piece of crap because it didn't function in humid conditions, so we had all these things come out to the system and what happens. All that stuff then went on and on and on.

So I think we almost need to incorporate that philosophy, what has happened in the past. And the best example I can give or hope that you would look at are the Israelis. The Israelis don't have time. You look at what they have done with their missile programs. You look at what they did in the Yom Kippur War that they almost lost and they changed certain things.

You look at the battleground, 2006 against Hezbollah along the Lebanese border, where they changed their MPCs [military personnel carriers] and tanks because the threat was there. And they didn't have 5, 10, 15, 20 years. They had to do it or they were going to not exist as a country.

And if you could comment very briefly, and I yak too much.

Dr. CHU. You have named some of the notable failures over time. I do think part of the——

Mr. COOK. I am old, so I named all the old systems.

Dr. CHU. We did get better, actually, over time, I would argue.

I think part of the solution is what others have advocated, which is often from the field perspective the 80 percent solution is good enough. And so one of the reasons for longer times to solve the problem than is meritorious is we aim too high. We ought to aim at, as I think your comments emphasize, what is most essential for accomplishing that mission. What does the troop really need in order to do a good job. If we get that done, we could then add to that success in a more evolutionary approach.

Mr. COOK. Thank you.

I yield back. Thank you.

The CHAIRMAN. Well, actually, I think that is a good way to end, because DOD may be better than government agencies, but we have also got more at stake. And so that is part of the reason that I very much appreciate you all's input today.

I know we will continue to engage with CSIS and IDA and BENS and GAO, but I want to encourage you all to continue to offer us your input. Don't wait for us to ask. This, as you know, is a complex subject with a lot riding on it, as we are going to be in an iterative process to try to improve it. And we need the assistance of people with valuable expertise and insights to help us do that.

So I appreciate today, and I appreciate your contributions in the future.

With that, the hearing stands adjourned.

[Whereupon, at 12:03 p.m., the committee was adjourned.]

A P P E N D I X

OCTOBER 27, 2015

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

OCTOBER 27, 2015

Statement of Ranking Member Adam Smith
HEARING ON
Shortening the Defense Acquisition Cycle
October 27, 2015

Thank you, Mr. Chairman. I wish to thank our witnesses for appearing this morning and for sharing with us their expertise on this important topic. Their insights are instructive to this committee's continuing efforts to assess and remediate the defense acquisition system.

An effective acquisition system is vital to national security, because the Department of Defense relies on superior technologies, products, and services to perform its various roles and missions. However, we know that familiar challenges to system effectiveness, such as cost overruns, schedule delays, and performance failures persist. The defense acquisition system must become more cost-effective as budgetary resources become more constrained.

Congress can help optimize efficiency and combat dysfunction in the acquisition system by completely eliminating the threat of sequestration. We know that sequestration inflicts grievous harm on vital federal priorities, which include numerous investments in future defense capabilities. Success in the acquisition arena requires greater budgetary certainty.

Congress must also continue to work with the Department and with industry in building on the achievements of previous reform efforts and in sustaining a concerted undertaking to improve the defense acquisition system. In doing so, we should: sharpen DOD's requirements generation and validation processes to set obtainable objectives; empower the acquisition work force; develop integrated acquisition data management systems to inform key decisions; foster innovation; enhance the vitality of the defense industrial base; and improve oversight of contractor performance.

Today's hearing will focus on streamlining the acquisition cycle with the goal of producing timely and cost-effective acquisition outcomes. However, if we simply shorten acquisition cycles as they currently exist, we may only succeed in trading notionally tighter schedules for heightened risks of programs incurring unaffordable costs or failing to meet requirements. Establishing realistic requirements, using modular open systems architectures and incremental development processes on a more widespread basis, and relying more on the availability of mature technologies could help mitigate those risks, while helping to expedite acquisition cycle timelines. The Department is making encouraging strides in each of these areas, but I am interested in exploring whether these and other types of initiatives might be nurtured to strike the appropriate balance between acquisition cycle time and risk.

In striking that balance, we must also stress the importance of competition and developmental testing within the acquisition cycle. Competition spurs innovation and helps to control costs, while rigorous and thorough testing ensures that reliable capabilities are realized prior to their delivery to the warfighter. Competition and developmental testing are both necessary and beneficial to a healthy acquisition system, but they both take time. In reviewing ways to shorten acquisition cycles, I would not wish to see the time afforded either of those variables significantly diminished.

Each of our witnesses has extensive experience in the defense acquisition arena. I hope to learn from them how we might effectuate constructive changes to the defense acquisition cycle.

Thank you, Mr. Chairman.

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Statement before the

House Armed Services Committee

"SHORTENING THE DEFENSE ACQUISITION CYCLE"

A Testimony by:

Andrew Hunter

Director, Defense-Industrial Initiatives Group

and Senior Fellow, International Security Program

Center for Strategic and International Studies (CSIS)

October 27, 2015

2118 Rayburn House Office Building

Chairman Thornberry, Ranking Member Smith, thank you for inviting me to testify today. I am Andrew Hunter, Director of the Defense-Industrial Initiatives Group at the Center for Strategic and International Studies. It is truly a pleasure for me to appear here to testify on "Shortening the Defense Acquisition Cycle." As a former staff member of this committee, and having worked closely with the Chairman Ike Skelton and Representatives Rob Andrews and Mike Conaway to support the Committee's one-year Panel on Defense Acquisition Reform, in my mind there is no better venue than this one for tackling this important subject.

My research at CSIS focuses closely on the defense acquisition system and the industrial base. Given the clear priority of this committee and your counterpart, the Senate Armed Services Committee on acquisition reform, I have spent the last year holding a series of working sessions with experts both inside and outside the current system, together with Hill staff, to explore opportunities for improvement of the acquisition system. These sessions will inform my testimony today.

Our hearing topic brings to mind an adage that is common in acquisition, and which remains profoundly true. It goes like this: "faster, better, cheaper ... pick any two." In other words, acquisition is about balancing priorities to generate investment outcomes that are responsive to warfighter needs. In order to optimize the defense acquisition system for one or two of these three outcomes, the third must inevitably be treated as a lower priority. As expressed mathematically by our current Secretary of Defense, Dr. Ashton B. Carter, in his former capacity as the Under Secretary of Defense for Acquisition, Technology, and Logistics, one of these has to be the independent variable that is allowed to fluctuate while the others are held constant.

Over the course of time the prioritization of these outcomes can and has shifted. In the face of the Soviet threat in the Cold War, there were many times in which "better" was the predominate priority, and cost and schedule were lesser priorities. The B-2 stealth bomber is an example of a program where cost was a secondary consideration, at least in the program's formative stages, and where schedule was also sacrificed (the program was

delayed at least two years by a major mid-stream design change). In that case, "better" was the priority because the B-2's revolutionary technological advances were considered essential to counter a serious threat from advances in Soviet air defenses. Not incidentally, the program was sharply curtailed when that threat collapsed.

More recently, during the wars in Iraq and Afghanistan, the priority has been placed squarely on "faster" and with good results. A variety of game changing capabilities were successfully fielded in a matter of months, not years. One example is the force protection advances achieved through rapidly fielding thousands of MRAPs, and associated efforts to add under body protection to a range of other vehicles. Another example is the advances in intelligence, surveillance, and reconnaissance capabilities generated by adding and integrating together highly modern new sensor systems on a wide variety of existing or commercially purchased air platforms. The rapid acquisition experience of the last decade shows the deep importance of having the ability to move quickly when warfighter requirements demand it. And make no mistake, our acquisition system is fully capable of doing so when properly tasked and incentivized.

At the same time, the current security environment is one where the United States' historical technological advantage is being eroded for a variety of reasons, many of which are examined in a CSIS report called "Keeping the Technological Edge: Leveraging Outside Innovation to Sustain the Department of Defense's Technological Advantage." This development is a growing source of concern for senior Department of Defense leaders as this committee has heard. The erosion in U.S. technological superiority necessitates developing a range of "better" capabilities that can address areas where the U.S. lead has been erased if not reversed, which is the objective of the Department's Defense Innovation Initiative.

And of course, as the recent veto of the National Defense Authorization Act (NDAA) for Fiscal Year 2016 demonstrates, we are also struggling to emerge from a sharp and severe down cycle in defense spending. That suggests that, for many programs there is much merit in prioritizing the acquisition of "cheaper" capabilities, particularly capabilities that

are cheaper to sustain. The choice of which priority, or which two priorities, to emphasize must differ from capability to capability, even in the same year, depending on the nature and function of the system being acquired.

This hearing's focus on "faster" is an important priority for a range of capabilities required to address urgent and emerging DoD requirements. I'd like to relate to you some lessons that I learned from my experience as the Director of the Joint Rapid Acquisition Cell at DoD from 2013-2014. In this capacity, I supported the Deputy Secretary of Defense in leading efforts to field capability in response to urgent warfighter needs. As part of shortening the defense acquisition cycle, this committee should work closely with DoD to ensure that the Department retains and institutionalizes the capability for rapid acquisition. Last week, former Secretary of Defense Robert Gates delivered powerful testimony to the Senate Armed Services Committee and addressed this issue at length, emphasizing the challenge he faced in getting the acquisition system to move faster. Ultimately, through extraordinary leadership and force of personality, Secretary Gates succeeded in pushing MRAPs and other rapidly fielded capabilities through the system. As he mentioned in that testimony, Secretary Gates correctly understood that it was important for future Secretaries to institutionalize the capacity to field responses to urgent and emergent operational needs. For an excellent explanation for how this can be done, I recommend you consult the article by Dr. Ashton B. Carter in the January/February 2013 issue of Foreign Affairs magazine entitled "Running the Pentagon Right, How to Get the Troops What They Need."

I will focus my testimony on a few key insights that I believe have broad applicability. The first key to institutionalizing rapid acquisition is flexible funding. The Department of Defense's Planning, Programming, Budgeting, and Execution System (PPBES), together with the appropriations process that complements it, can be a major impediment to rapid acquisition. In the normal operation of PPBES, it takes at least two years from the moment that a new priority is identified until significant resources can be allocated to begin to address it. This timeline can be shortened through use of reprogramming authority, but that requires the identification of lower priority programs from which

funding can be taken. In most cases, the obstacle to successful execution of the reprogramming process surrounds the source of the funds rather than the destination. Getting over this hurdle in the last several years was substantially assisted by the existence of flexible funds created by Congress such as the MRAP Transfer Fund, the Joint IED Defeat Fund, and the Iraqi Freedom Fund that were designed to help the Department in addressing urgent operational needs. Even when these funds were at their largest, the Department still exercised its general reprogramming authority extensively to enable rapid acquisition. A significant issue for institutionalizing rapid acquisition is the fact that most of these flexible funding mechanisms have been ended or sharply scaled back. While the reduction in these mechanisms makes sense given the drawdown in operations, it is nonetheless vital that some of these mechanisms not be terminated completely.

Another key to institutionalizing rapid acquisition is the importance of senior leadership involvement and shortened lines of authority. This concept is succinctly expressed in this year's revised DoD Instruction 5000.02 Enclosure 13, "Rapid Fielding of Capabilities." Enclosure 13 formalizes many of the techniques developed for rapid acquisition, and it directs that: "Approval authorities for each acquisition program covered by this enclosure will be delegated to a level that promotes rapid action." Rapid acquisition succeeds when senior leaders are involved in ensuring that programs are able to overcome the inevitable hurdles that arise during acquisition, and empower those responsible with achieving the right outcome with the authority to get the job done while minimizing the layers in between.

For clarity, let me explain how I believe this relates to the debate in this year's NDAA over milestone decision authority for major defense acquisition programs. I believe it is appropriate for the Secretary of Defense to delegate milestone decision authority for MDAPs in the execution phase to levels of the acquisition management chain in the military services, consistent with the program's complexity. Milestone B, however, comes at the end of the planning and risk reduction phase, prior to program execution, and is the point at which the critical investment and strategy decisions are made. For

MDAPs, these decisions require significant commitment from the entire DoD enterprise, and the Secretary and his principal staff assistant for acquisition, the Under Secretary of Defense for Acquisition, Technology, and Logistics, are best positioned to ensure these commitments are sound. For this reason, I believe it is most appropriate to leave the discretion to delegate or retain milestone decision authority at milestone B within the Office of the Secretary of Defense for MDAPs. In this construct, rapid acquisition is essentially a special case because the fundamental decision to proceed with a program (the investment decision) is made when a requirement is designated as an urgent operational need.

In my view, the real power in shortening lines of authority for acquisition programs lies much more in streamlining the workload of documentation and coordination within all elements of the acquisition system rather than in excluding elements of the system. In fact, my experience in rapid acquisition is that speed is best accomplished when everyone is included in the process, along with senior leadership, so that decisions made are rapidly disseminated to all elements of the system and program execution can proceed accordingly.

The last key to institutionalizing rapid acquisition is ensuring constant communication with the operational and intelligence communities. Rapid acquisition is fundamentally an ongoing dialogue between the acquisition and operational communities about what the real needs of the warfighter are and what the art of the possible is in addressing them. In rapid acquisition particularly, this means continually updating the operational community on what capability can be delivered on what time frame, and staying continuously in touch with how threats are evolving. This dialogue is the area where the parts of DoD that do best at rapid acquisition, such as the Special Operations Command, the ISR Task Force, and the Joint Improvised-Threat Defeat Agency (formerly JIEDDO) excel and provide their greatest value. In rapid acquisition, testing is included as part of this dialogue. Rapidly fielded capabilities are tested to the point where the warfighter is willing to accept them for use, rather than to a separate measure of effectiveness and suitability.

I want to be clear that rapid acquisition is not a panacea for acquisition. As I've outlined, "faster" is not the top priority for every system, and certain of the methods employed in rapid acquisition wouldn't be applicable to certain major investment program. However, the key principles I've outlined as critical to rapid acquisition are also applicable in many ways more generally. Indeed, in this testimony, I have endeavored to frame these key principles in a way that best lends itself to broader application in the acquisition system by moving back from particular instances, e.g. the specific details of working reprogramming requests for urgent operational needs, to the more general importance of financial flexibility, shorter lines of authority, and continuous dialogue between operators and the acquisition system. Not only are these points important where "faster" is the primary objective, they can have relevance when other outcomes are the priority. Having an appropriate degree of financial flexibility and shorter lines of authority can also help to reduce costs when "cheaper" is the priority, for example, by reducing the likelihood that the standing army of engineers associated with weapons programs in development are idled waiting for a change in the budget to allow them to proceed with program execution. Similarly, financial flexibility and continuous dialogue between operators and the acquisition system can enhance the ability to rapidly incorporate emerging technologies when "better" is the priority by enabling programs to capitalize on unexpected technology developments.

Increasing financial flexibility was not a major focus of the acquisition reform provisions in the latest NDAA and I believe it should be a focus for upcoming legislation. The exact approach for how to increase financial flexibility in the acquisition system while maintaining budget discipline is a matter of ongoing debate in the working group discussions that CSIS has been hosting. I would be happy to update the committee on these recommendations when they have reached a more mature state of development. I believe many of the changes adopted in the pending NDAA can help to shorten lines of authority for acquisition. It is important to note, however, that these statutory changes will be for naught if they are not associated with significant revisions to the documentation requirements in regulation. Following up on whether corresponding changes are made in regulation should be an important area of examination for the

committee in the coming year. I also believe that the decision to increase the role of the service chiefs in the acquisition process is a valuable step in promoting the dialogue between operators and acquisition that I've described as a key to rapid acquisition. However, effective dialogue at working levels that facilitate decisions made by senior leaders is where the real key to unlocking the potential of this approach lies.

Ultimately, there is a significant degree to which shortening acquisition cycles requires a willingness to consider new paradigms, for example with regard to highly adaptable systems. An example is the Predator/Reaper/Gray Eagle system (hereinafter referred to as Predator), which has probably incorporated more technology and fielded more new capability to the battlefield than any other platform in the last decade. Predator has been modified over and over again in response to warfighter needs, and its capability has been enhanced greatly as a result. Due to this increased capability, it remains a central platform for operations such as the current counter-ISIL campaign. Predator has never fit neatly or naturally into the mainstream defense acquisition system and I have come to believe that capabilities like this probably should not be forced to fit into the traditional system. It is practically impossible to properly evaluate programs such as Predator in the usual approach taken by oversight processes such as Selected Acquisition Reports, Nunn McCurdy, and other related mechanisms.

I believe that the Department should explore using the new authorities of the pending NDAA, particularly the "Middle Tier" authority provided in Section 804, to pilot a new approach to these kinds of highly adaptable systems that rapidly incorporate new technologies. In doing so, it may be necessary for the committee to work with DoD to make some small modifications to this authority in future legislation. On the negative side, the cost growth penalties included in Section 828 of the pending NDAA are particularly problematic for adaptable systems. Section 828 imposes a recurring annual penalty on the military services for any capability growth added to a system baselined after mid-2009, which Sec. 828 rigidly regards as cost growth irrespective of the reason for the decision to increase the program. True utilization of adaptable approaches to acquisition may be effectively precluded by this provision. For a more detailed

discussion of the characteristics and advantages of adaptable systems, I recommend review of the 2011 Defense Science Board report entitled "Enhancing Adaptability of U.S. Military Forces."

It appears likely, and is much to be hoped for, that an increasing number of adaptable systems will come forward for approval in the next few years. The Long Range Strike Bomber, whose contract is likely to be awarded later today, is conceived by the Air Force as an adaptable system, and my understanding is that the Air Force also plans an adaptable approach to the nascent JSTARS replacement program. The Navy's UCLASS program would certainly be a candidate for an adaptable approach. In many ways, the Navy's Acoustic Rapid COTS Insertion program, which is still working to upgrade the combat systems on Navy attack submarines, is the prototype for adaptable system acquisition approaches.

In summary, Mr. Chairman, I commend the committee for tackling the question of how to shorten defense acquisition cycles. I believe the committee can make significant progress on this question by institutionalizing rapid acquisition processes, applying some of the central lessons learned from rapid acquisition to the acquisition system generally where applicable, and by encouraging (and not inhibiting) the development of adaptable systems. Thank you again for the opportunity to testify.

Andrew Hunter

Director, Defense-Industrial Initiatives Group and Senior Fellow, International Security Program

Andrew Hunter is a senior fellow in the International Security Program and director of the Defense-Industrial Initiatives Group at CSIS. He focuses on issues affecting the industrial base, including emerging technologies, sequestration, acquisition policy, and industrial policy. From 2011 to November 2014, Mr. Hunter served as a senior executive in the Department of Defense (DOD). Appointed as director of the Joint Rapid Acquisition Cell in 2013, his duties included fielding solutions to urgent operational needs and leading the work of the Warfighter Senior Integration Group to ensure timely action on critical issues of warfighter support. From 2011 to 2012, he served as chief of staff to Ashton B. Carter and Frank Kendall, while each was serving as undersecretary of defense for acquisition, technology, and logistics. Additional duties while at DOD include providing support to the Deputy's Management Action Group and leading a team examining ways to reshape acquisition statutes.

From 2005 to 2011, Mr. Hunter served as a professional staff member of the House Armed Services Committee, leading the committee's policy staff and managing a portfolio focused on acquisition policy, the defense industrial base, technology transfers, and export controls. From 1994 to 2005, he served in a variety of staff positions in the House of Representatives, including as appropriations associate for Representative Norman D. Dicks, as military legislative assistant and legislative director for Representative John M. Spratt Jr., and as a staff member for the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China. Mr. Hunter holds an M.A. degree in applied economics from the Johns Hopkins University and a B.A. degree in social studies from Harvard University.

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COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the U.S. House of Representatives for the 114th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), or contracts or payments originating with a foreign government, received during the current and two previous calendar years either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. This form is intended to assist witnesses appearing before the House Committee on Armed Services in complying with the House rule. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number) will be made publicly available in electronic form not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary.

Witness name: Andrew Hunter

Capacity in which appearing: (check one)

◉ Individual

◯ Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: Center for Strategic and International Studies

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, please provide the following information:

2015

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Contract	Naval Post Graduate School	Apx. $120,000.00	STUDY: Designing and Managing Successful International Joint Development Prog
Contract	Naval Post Graduate School	Apx. $120,000.00	STUDY: Federal Research and Development Contract Trends and the Supporting In

2014

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Contract (initiated by a previous CSIS scholar)	Naval Post Graduate School	Apx. $120,000.00	STUDY: Analysis of Defense Products Contracts Trends, 1990-2013
Contract (initiated by a previous CSIS scholar)	Naval Post Graduate School	Apx. $120,000.00	STUDY: Measuring the Success of Acquisition Reform by Major DoD Components
Contract (initiated by a previous CSIS scholar)	Naval Post Graduate School	Apx. $120,000.00	STUDY: Competition & Bidding Data as Indicator for U.S. Defense Industrial Base
Contract (initiated by a previous CSIS scholar)	Naval Post Graduate School	Apx. $120,000.00	STUDY: Avoiding Terminations, Single Offer Competition, & Costly Change Orders
Contract (initiated by a previous CSIS scholar)	DoD- Defense Logistics Agency	Apx. $375,000.00	STUDY: Research & Development Study and Performance Analysis

2013

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Contract	DoD- Defense Technical Information Center	Apx. $200,000.00	STUDY: Process-Leading Innovation

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2015

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2014

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2013

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

Defense Acquisition Cycle Time

David S. C. Chu

House Armed Services Committee
**October 27, 2015**

Mr. Chairman and Members of the Committee: Thank you for the opportunity to participate in today's hearing. While some of my remarks are based on research by a variety of institutions, others are based on my service in the Department of Defense; neither the interpretation of those research results nor reflections on past experience should be taken as an institutional position—they represent my personal views.

Concern with cycle time is not a new issue

As members of the Committee are well aware, concern with cycle time in defense acquisition is not a new issue. The Packard Commission, for example, criticized an "unreasonably long acquisition cycle", which it blamed on the management environment, both in the Executive and Legislative Branches.[1] Much earlier, Samuel Eliot Morison, the distinguished historian, noted the role that non-traditional designs and designers—e.g., Henry Kaiser, at President Roosevelt's direction--played in cutting the time to produce ships for the Navy in World War II.[2]

While I recognize some believe DoD cycle times are worsening, the Selected Acquisition Reports raise doubts that's the case for Major Defense Acquisition Programs, looking at the last 25 years (including sub-programs when so divided, e.g., engine separate from aircraft). Cycle time is defined in Figure 1 as the period from start date, as best that can be established, to Initial Operating Capability (IOC). These data do not suggest an overall trend toward longer cycle times.[3]

Figure 1: Cycle Time vs. IOC Year
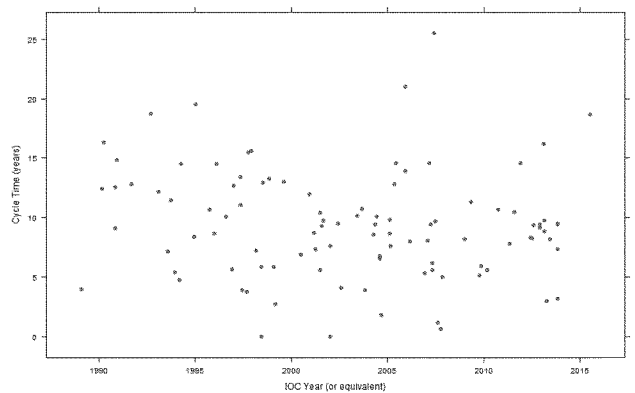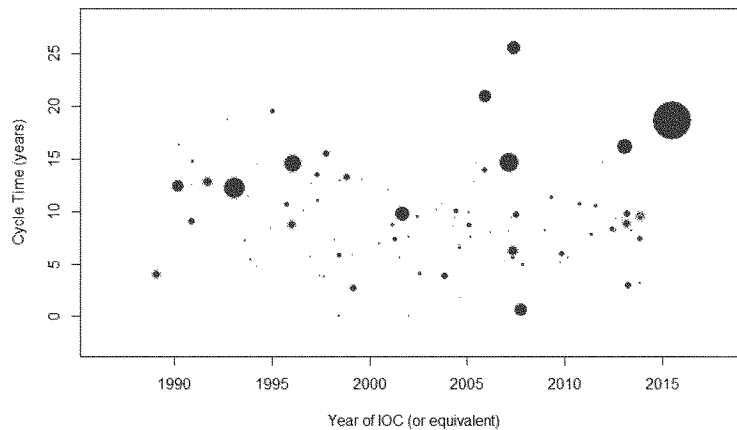

Source: Selected Acquisition Reports

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[1] Packard, David, et al. "A Quest for Excellence: Final Report to the President by the President's Blue Ribbon Commission on Defense Management," June 1986, p. 47.

[2] Morison, Samuel Eliot. *History of the United States Naval Operations in World War II, Vol. X: The Atlantic Battle Won, May 1943-May 1945*. Chicago: University of Illinois Press, 1956. p. 41.

[3] The Department of Defense is cautiously optimistic about recent experience, using development contract length as its measure of merit, although it warns that this may reflect a program mix with more modifications than true new starts. See *Performance of the Defense Acquisition System, 2015 Annual Report*. Washington, DC: Under Secretary of Defense, Acquisition, Technology, and Logistics (USD[AT&L]), September 2015, p. 79.

Impressions to the contrary may reflect experience with some very large systems. Figure 2 repeats the data of Figure 1 but with the dots proportional to program size, as measured by total procurement costs. The three large dots in the upper right plot the results for the F-22, V-22 and F-35. As Figure 2 depicts, these programs took 15 to 25 years to reach IOC, with two of the three F-35 variants still in development. In contrast, the median cycle time for all Major Defense Acquisition Programs has been stable at 8-9 years over the last three decades (unweighted by procurement cost), and the cycle time for all MDAPs approximates a normal distribution around that central tendency.

Figure 2: Cycle Time Proportional to Total Program Procurement Costs

Year of IOC (or equivalent)

Source: Selected Acquisition Reports

As both figures demonstrate, there's considerable variance in observed cycle time, and several outliers whose cycle times are cause for concern. Moreover, a tabulation like this cannot speak to the effect of recent changes (e.g., due to the Weapon System Acquisition Reform Act of 2009, or the DoD Better Buying Power Initiatives), since any program that has yet to reach IOC is by definition excluded.

In the beginning...

The literature with which I'm familiar, and certainly my observations from service in the Department, argue that the causes of cycle time issues can often be traced to the start of the acquisition process—that is, in the statement of "requirements". Ambitious technical objectives, which may not have been fully researched against what may be possible given the state of technology, can lead to long development times.[4]

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[4] Recent defense examples include Richard Van Atta, "Understanding Acquisition Cycle Time", IDA D-5065, 2013; Gene Porter et al, "The Major Causes of Cost Growth in Defense Acquisition—Volume I: Executive Summary, IDA P-4531, 2009; and Jesse Riposo et al, "Prolonged Cycle Times and Schedule Growth in Defense Acquisition, RAND RR-455-OSD, 2014. For the relationship between complexity and engineering time for the development of auto parts, see Michael D. Johnson and Randolph E. Kirchain, "The Importance of Product Development Cycle Time and Cost in the Development of Product Families", Journal of Engineering Design, Vol. 22, No. 2, February 2011, 97-112. Long development times may be justifiable:

Moreover, the incentives under which program managers operate can reinforce this tendency. Rewards to DoD managers accrue from programs that proceed—not typically to advice that program parameters should be seriously reconsidered, or initiatives abandoned as unpromising.[5] This incentive structure favors continuing troubled programs—among other costs, postponing the day that we actually field needed new capabilities. Moreover, fiscal limits encourage the Military Departments to advance optimistic views of what can be achieved, inserting more content into budget plans than is realistic. And the incentives facing companies in the US system do not encourage realism about development times: profits accrue principally from production, not development, creating an obvious incentive to plan on early production, and optimism about development schedules, even if the technological effort may in reality require more time.

Recent research raises the possibility that the funding environment may play a role. Cost growth, at least, appears to be strongly associated with the funding climate. Cost growth tends to be high for Major Defense Acquisition Programs that pass Milestone II/B in periods when the procurement budget is tight, and much lower for those that pass Milestone II/B in "boom" periods.[6] How this relates to cycle time remains to be analyzed. And it should be acknowledged that keeping potential future possibilities available by slowing development in periods of tight fiscal constraint may indeed be a prudent option.

What might we do differently?

A frequent recommendation is to streamline the oversight process—"cut red tape". It's noted that program managers spend a significant amount of time informing oversight entities about their progress, and seeking permission to proceed.[7] The Department of Defense is committed to a more streamlined process.[8] But while it's appropriate to eliminate unnecessary reporting burdens, the existing burdens may be more a symptom of the challenges inherent in Defense procurement, not a cause of delay. First, while the Military Departments execute programs, the Secretary of Defense is ultimately responsible, and will want an effective oversight mechanism, for which the Congress will hold him accountable. Second, DoD operates in a political environment that is unsympathetic to error, not in a market system where profit and loss results provide the necessary discipline regarding courses of action. Much more powerful than streamlining per se would be creating an incentive structure in which the possibility of failure is dealt with more realistically—in essence, deciding strategically how much failure we're willing to tolerate, vice adding additional reviews as a response to the failures that actually occur. Perhaps a first step would be creating a prize for the best idea that didn't work out, so that risk-taking within reason is applauded, not penalized!

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see, for example, recent discussion of the new Pratt and Whitney Pure Power Geared Turbofan aircraft engine: Coy, Peter. "The Little Gear That Could Reshape the Jet Engine", *Bloomberg Businessweek*, published online October 15, 2015 and *Bloomberg Businessweek* print magazine, October 19-25 edition.

[5] Intel, as one contrasting commercial example, is believed to reward program managers for good advice, including advice that a program initiative is a bad investment. See Graham, David R. et al., "Strengthening DoD Laboratories: A Proposal for a Virtual Central Laboratory to Support Enterprise-Level Innovation", IDA P-4976, March 2013, p. 7-8, 13-14.

[6] David L. McNicol and Linda Wu, "Evidence on the Effect of DoD Acquisition Policy and Process on Cost Growth Major Defense Acquisition Programs", IDA P-5126, September 2014. A summary of this paper is included in *Defense Acquisition Reform: Where Do We Go from Here? A Compendium of Views by Leading Experts.* Staff Report prepared by the Permanent Subcommittee on Investigations of the United States Senate Committee on Homeland Security and Governmental Affairs, as "Cost Growth, Acquisition Policy, and Budget Climate", pp. 149-155.

[7] See, for example, Christle, Gary E. and Donald A. Birchler, "Strategic Management System for Navy Acquisition", CNA CAB D0013765.A2/Final, March 2006.

[8] *Performance of the Defense Acquisition System, 2015 Annual Report*. Washington, DC: Under Secretary of Defense, Acquisition, Technology, and Logistics (USD[AT&L]), September 2015, p. 53ff.

Consistent with the finding that lengthy development schedules typically originate from flaws in the requirements process,[9] it's essential to appraise technological risk more realistically at the outset of programs. The Weapons System Acquisition Reform Act of 2009 strengthened Developmental Testing--a step in the right direction. But I believe it would be meritorious to go further, and to look explicitly at the parameter tradeoffs when "requirements" are being set, given a reasonable view of how far technology could advance.[10] Indeed, it would be salutary to drop the word requirements, and acknowledge that we are picking a point within the available tradeoff space. Sensible adjustments can then be made during the course of system development, trading off among parameters, as circumstances dictate (e.g., when we have unexpected difficulty, or unexpected ease, in securing a desired parameter value). After all, the ultimate standard is not whether the system satisfies particular ex ante engineering parameter values, but whether the new article's performance, relative to what we already possess, merits the investment—in the end, how well can it perform the mission that is the reason for its acquisition? Too often we pick points that are at the outer edge of the tradeoff space— if not outside it altogether—creating a lengthy development process as we strive to attain unrealistic "requirements".

Given the uncertainties contemporary military planners face, perhaps we should be especially cautious about the design point selected, from the perspective of technological ambition, if such caution would allow easier adjustment of the design as mission needs change—particularly if such changes occur after the actual deployment of the article in question. As my colleagues have phrased it in the compelling title of their paper, DoD should "prepare to be wrong".[11]

Even in the Cold War, we were compelled to adapt equipment to new mission circumstances; the example often cited is morphing the B-52 from a high altitude bomber to a low-altitude penetrator, facilitated by the ruggedness of its design. Why not allow more consistently for the likelihood we will have to adapt to new mission needs, e.g., establishing generous initial space/power/weight allowances, thus shortening the modification cycle time? This acquisition strategy, I believe, is particularly attractive for major "platforms", since they are both expensive to develop and typically long-lived, continuing in the inventory in many cases for decades.

The Defense Science Board in its 2010 Summer Study, "Enhancing Adaptability of US Military Forces," recommended aligning the Defense enterprise to operational cadence.[12] This creates an alternative approach to managing cycle time, especially in the circumstance of repeated deployments. Borrowing from the Navy's practice for submarine software upgrades (which are targeted on specific boat deployment dates), the DSB recommended that development efforts (e.g., block upgrades of systems) be keyed more generally to specific unit deployment schedules. To succeed, this approach requires great discipline in setting the objectives for system development—too ambitious, and you are likely to miss the deployment. In essence, cycle time becomes a key performance objective.

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[9] For a further example, see Dubos, Gregory F., et al, "Technology Readiness Level, Schedule Risk and Slippage in Spacecraft Design: Data Analysis and Modeling", AIAA SPACE 2007 Conference & Exposition, September 2007.

[10] For a discussion of how this could be done, see Patel, Prashant R. et al, "Defining Acquisition Trade Space Through 'DERIVE.'" *IDA Research Notes, Acquisition: Part 1: Starting Viable Programs*, Fall 2013.

[11] Patel, Prashant R. and Michael P. Fischerkeller, "Prepare to be Wrong: Assessing and Designing for Adaptability, Flexibility, and Responsiveness", IDA P-5005, April 2013.

[12] See *Report of the Defense Science Board 2010 Summer Study on Enhancing Adaptability of U.S. Military Forces: Part A: Main Report*. Washington, DC: Under Secretary of Defense, Acquisition, Technology, and Logistics (USD[AT&L]), January 2011, p. viii-x.

It's also possible that we could look overseas more frequently for articles that could serve as a starting point for our own developments. Much has been made of "globalization", but it is certainly the case that the technological capabilities of a number of nations have now reached a high level, in weapons development, as in other areas.[13] Key to the rapid development of the Mine-Resistant Ambush-Protected Vehicles for Iraq were the design results from the Canadian Light Armored Vehicle and extensions by South Africa.

Much more challenging is changing the incentive structure of Defense development to reward program managers for helping the enterprise make good decisions, vice the *status quo* in which success is defined as a program that reaches the production stage. The revised incentive structure must promote realism about both schedule and the prospects for success—on the part of the Military Departments as well. Such a change in incentives would facilitate a hedging strategy for system development, deliberately starting more programs than you intend to pursue. The incentives must be strong enough, and the discipline of the system rigorous enough, to restrain how many programs are selected for production, lest you create a bow wave of future financial needs. But that larger portfolio would give you a richer set of choices over time, a form of insurance against the uncertain (and unpredictable) nature of the military challenges we will face in the future.

A further change would be to consider a greater degree of separation of development from production, so that well-run developments are prized for their own sake, quite apart from whether they are taken to production. That necessitates making development financially rewarding, and perhaps even encouraging institutions that specialize in development activities, separate from those that produce finished articles, requiring also, of course, mechanisms to ensure that the designs produced can be easily and economically manufactured. Perhaps an organized, strategy-driven prototyping program could provide the foundation for such a change in the American defense acquisition paradigm.

Even if Defense were more deliberate and realistic in establishing planned cycle times, you would expect to see variance in the choices. An "optimal" cycle time balances the various considerations against the needs of the period. Not only do the choices embody implications for what can be developed (and a risk factor regarding outcomes), they can also affect cost, the industrial base, the timing of the system's availability, and the breadth of the Department's development portfolio. Stark versions of these choices often arise in wartime—the US could produce the vital Liberty ships so quickly in World War II at least in part because it was willing to accept a design not made to last.

Whatever courses of action are selected, there is no substitute for an informed technical staff whose interest is the government's success, whose leadership has the ability to enforce realism in setting goals and schedules, and the wisdom to aim at system characteristics that are properly aligned with mission needs and resource constraints. Human capital—as is true in so many other elements of military endeavor—may be the most important ingredient. The ultimate objective is not meeting a particular cycle time metric, but ensuring that American military forces have what they need to secure our national interests, on the timelines that circumstances dictate. That is the responsibility of the people who serve the Department, and the leaders who organize their efforts.

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[13] See, for example, Hull, Andrew W. and David R. Markov, "Acquisition in a Global Technology Environment", *IDA Research Notes, Technological Innovation for National Security*, Fall 2014.

VITA
David S.C. Chu

Born:
New York City, 28 May 1944

Education:
BA, Economics and Mathematics, magna cum laude, Yale University, 1964
MA, Economics, Yale University, 1965
MPhil, Economics, Yale University, 1967
PhD, Economics, Yale University, 1972

Military:
U.S. Army, 1968-1970, including:
Instructor, U.S. Army Logistics Management Center, Fort Lee, VA, 1968-1969
Office of the Comptroller, Hq., 1st "Logistical Command, Republic of Vietnam, 1969-1970
Discharged as Captain, June 1970

Professional:
President and CEO, Institute for Defense Analyses, April 2009-present
Senior Fellow, RAND, January 2009-March 2009
Under Secretary of Defense (Personnel and Readiness), June 2001-January 2009
Vice President, Army Research Division, RAND, and Director, Arroyo Center, June 1998-January 2001
Director, Washington Office, and Associate Chairman of the Research Staff, RAND, March 1996-June 1998
Director, Washington Research Department, RAND, January 1994-March 1996
Senior Fellow, RAND, January 1993-January 1994
Assistant Secretary of Defense (Program Analysis and Evaluation), July 1998-January 1993, and Director, Program Analysis and Evaluation, Office of the Secretary of Defense, Department of Defense, May 1981-July 1998
Assistant Director for National Security and International Affairs, Congressional Budget Office, April 1978-May 1981
Associate Head, Economics Department, RAND, August 1975-April 1978
Economist, RAND, October 1970-April 1978
Lecturer, Department of Economics, University of California (Los Angeles), 1972-1973
Consultant, Development Center, OECD, Paris, May-August 1965

Public Service:
Defense Science Board, 2009-present
Naval War College Board of Advisors, 2012-2014
University of Maryland National Security Advisory Committee, 2009-present, and School of Public Policy Board of Advisors, 2009-2014
The Language Partnership Group Board of Directors, 2009-2014
The Economics of National Security Association Board of Directors and Vice President, 2013-present
National Military Family Association Board of Advisors, 2009-present

67

Army Science Board, 1999-2001
Trustee, National Academy of Public Administration, 1995-2001
    (Chairman of the Board, 1998-2001)
Trustee, National Presbyterian School, 1995-2001

Honors:
Phi Beta Kappa
Honorary Woodrow Wilson Fellow
National Science Foundation Fellow
Foreign Area Fellowship Program Fellow
Fellow, National Academy of Public Administration
Honorary Master of Arts, National Security and Strategic Studies, Naval War College

Decorations and Awards:
Department of Defense Medal for Distinguished Public Service, 1987; Bronze Palm,
    1988; Silver Palm, 1993 and 2006; Gold Palm, 2009
Department of Veterans Affairs, Meritorious Service Award, 2009
Department of the Army Distinguished Civilian Service Award, 2009
Department of the Navy Distinguished Public Service Award, 2003
Vance R. Wanner Memorial Award of the Military Operations Research Society, 1993
National Public Service Awards, American Society of Public Administration and National
    Academy of Public Administration, 1990
Elmer B. Staats Award, National Capital Area Chapter, American Society for Public
    Administration, 1986
Army Commendation Medal, Bronze Star

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Witness name: Dr. David S.C. Chu

Capacity in which appearing: (check one)

⦿ Individual

◯ Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: _____

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Business Executives for National Security

Testimony of Joe Pasqua
Member of Business Executives for National Security

Before the United States House of Representatives
Armed Services Committee

October 27, 2015

Chairman Thornberry, Ranking Member Smith, Members of the Committee, my name is Joe Pasqua. I am honored to appear before this committee as a private citizen and member of Business Executives for National Security (BENS). Having been asked to address ways to shorten the Defense Acquisition cycle, my statement today will address how the rapid pace of innovation has affected the information technology requirements and acquisition processes in the private sector, and how open architecture can enhance an organization's agility and ability to adopt innovation.

My testimony will be based on my over three-decade career in the information technology (IT) industry and my experiences at companies including Xerox, Symantec, Veritas, and currently as Executive Vice President for Products at MarkLogic Corporation. As I stated, I also appear before you today as a member of Business Executives for National Security, a non-profit non-partisan organization that for over thirty years has been a primary conduit through which private sector leaders can help build a more secure America.

Although my testimony is reflective of BENS' perspectives on how private sector best practices can improve public sector efficiency, the views I express are my own.

As an informed observer I would like to first congratulate the Committee on your efforts at acquisition reform. I agree with Chairman Thornberry's approach to make incremental, modest (and subsequently achievable) changes as a means to realize the comprehensive reform necessary. Much of that reform needs to take place in the ways in which information technology requirements are determined, developed, and acquired.

Information technology underpins the vast majority of capabilities in the public and private sectors. Therefore, an organization's capacity to efficiently acquire IT and adopt innovation has become fundamental in today's operating environment. In this vein, we have seen that the smaller, more agile companies are often the most disruptive and the most innovative. However, because of their disruptive nature they are also often the most difficult to engage and work with. For this reason, I would like to commend the Department of Defense for its progress in forging connections with smaller, more agile IT companies.

In the past, barriers for both the Department and these small companies have impeded building effective partnerships. Traditionally, smaller companies have not viewed DOD as a viable customer because of the myriad requirements associated with doing business with the Department. Navigating the requirements process and long timelines creates a high barrier to entry for smaller companies. Indeed, it isn't that these companies don't want to engage with DOD, rather doing so is too high a risk for these innovative but still young businesses.

Likewise, in an increasingly crowded market space it can often be difficult for the Department to identify which small company with which to engage, and even harder to adjust its requirements processes once it has decided to engage.

So the question becomes, how are nongovernmental companies engaging with these disruptive innovators? The answer is that there has been a fundamental shift over the last 5 to 7 years in the private sector's requirements and acquisition processes. The rapid pace of innovation has made the longer, more expensive requirements processes untenable. As a result, we are seeing less of what I call "big bang" acquisitions.

Instead, companies are starting small, conducting iterative evaluations in real-time, and adjusting as needed. Advances in cloud computing and scale-out architectures have enabled companies to do several proof of concepts and purchase IT hardware as they need it rather than investing in an expensive system in advance. This is a challenge for large organizations which have much more inertia and a lower risk threshold. But even here we are observing a trend toward more transformed acquisition processes as they try to adapt at a similar pace as their disruptive competitors.

An important point must be made here. The smaller scale approach not only allows an organization to adopt innovative technology more quickly, it also helps to address and mitigate risk up front. Traditional requirements processes are intended to mitigate risk by conducting long-term studies, contracting with consultants, and ensuring all options are reviewed in advance of the decision. An agile approach, however, allows companies to start small, avoid making large up-front investments, get a quick read on what was implemented, and scale up as appropriate. Keeping the initial investment small helps to reduce the overall risk and obviates the need for longer requirements processes.

In fact, inherent in a traditional long-term requirements process is the risk that the solution an organization seeks to acquire will be the wrong fit for the market once they acquire it. Indeed, this is a new type of risk that private sector companies are factoring in. Nowhere is this truer than in cyberspace, where the pace of innovation changes the environment on a seemingly monthly basis. A two-year acquisition process will almost guarantee that the solution will be outdated by the time it is realized. In such a dynamic space, the requirements process needs to account for an organization's current needs and be able to adapt to an inevitable change in the market space.

This is one of the primary effects of the pace of innovation and one way to accommodate it is through open architecture. No longer can companies acquire large systems by planning into the future to the "N^{th}" degree because by the time that future arrives the inputs will have changed, new inputs will have been developed, and the competitor and market space will be different. Open architecture allows an organization to build a system that is suited for today's issues and adaptable to tomorrow's changes. It provides increased interoperability, modularity, and the ability to incorporate new technologies without overhauling an entire system.

As an example, at some point a company will emerge that will provide a very effective technology that won't be able to do everything, but will solve one very important problem. A cybersecurity firm, for example, that doesn't provide end-to-end security but excels in one specific area. In a closed architecture it would be very difficult if not impossible to incorporate that new, niche technology. Conversely, open architecture allows an organization to evaluate new technologies and then decide whether to adopt them.

In summary, the private sector has benefited from the rapid pace of innovation while decreasing their acquisition cycle time by using smaller-scale, agile acquisition processes which reduce risk in a new way. They also increasingly employ open architectures to accommodate the undefined but inevitable changes that will take place in the market.

I recognize that in a large organization such as DOD it will be difficult to fully implement even some of these practices across the organization. However, reviewing best practices and understanding and implementing these approaches would help the Department to become more

agile and responsive to innovation, allow a slightly different yet still effective risk mitigation strategy, and encourage participation from a wider segment of industry.

Thank you for the invitation to testify. I am prepared to answer any questions you may have.

Joe Pasqua
Business Executives for National Security

Joe brings over three decades of experience as both an engineer and a leader. He has personally contributed to several game changing initiatives including the first personal computer at Xerox, the rise of RDBMS in the early days of Oracle, and the desktop publishing revolution at Adobe. In addition to his individual contributions, Joe has been a leader at companies ranging from small startups to the Fortune 500.

Prior to joining MarkLogic where he oversees all product definition, development, and support, Joe held a number of executive roles including VP of Strategy, VP of Global Research, and CTO of the $2B Data Center Management business at Symantec Corporation.

Joe's technical interests include system software, knowledge representation, and rights management. He has over a dozen issued patents spanning these areas.

Joe earned simultaneous Bachelor of Science degrees in Computer Science and Mathematics in 1981 from California Polytechnic State University San Luis Obispo where he is a member of the Computer Science Advisory Board.

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none			

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DEFENSE ACQUISITIONS

Joint Action Needed by DOD and Congress to Improve Outcomes

Statement of Paul L. Francis, Managing Director
Acquisition and Sourcing Management

GAO-16-187T

GAO Highlights

DEFENSE ACQUISITIONS

Joint Action Needed by DOD and Congress to Improve Outcomes

Why GAO Did This Study

DOD's acquisition of major weapon systems has been on GAO's high risk list since 1990. Over the years, Congress and DOD have continually explored ways to improve acquisition outcomes, including reforms that have championed sound management practices, such as realistic cost estimating, prototyping, and systems engineering. Too often, GAO reports on the same kinds of problems today that it did over 20 years ago.

This testimony discusses (1) the performance of the current acquisition system; (2) the role of a sound business case in getting better acquisition outcomes; (3) systemic reasons for persistent problems; and (4) thoughts on actions DOD and Congress can take to get better outcomes from the acquisition process. This statement draws from GAO's extensive body of work on DOD's acquisition of weapon systems and the numerous recommendations GAO has made on both individual weapons and systemic improvements to the acquisition process.

What GAO Found

U.S. weapon acquisition programs often take significantly longer, cost more than promised and deliver fewer quantities and capabilities than planned. It is not unusual for time and money to be underestimated by 20 to 50 percent. As the Department of Defense (DOD) is investing $1.4 trillion to acquire over 75 major weapon systems as of March 2015, cost increases of this magnitude have sizeable effects. When costs and schedules increase, the buying power of the defense dollar is reduced. Beyond the resource impact, consequences include the warfighter receiving less capability than promised, weapons performing not as well as planned and being harder to support, and trade-offs made to pay for cost increases—in effect, opportunity costs—not being made explicit.

GAO's work shows that establishing a sound business case is essential to achieving better program outcomes. A program should not go forward without a sound business case. A solid, executable business case provides credible evidence that (1) the warfighter's needs are valid and that they can best be met with the chosen concept, and (2) the chosen concept can be developed and produced within existing resources—such as technologies, design knowledge, funding, and time. Establishing a sound business case for individual programs depends on disciplined requirements and funding processes, and calls for a realistic assessment of risks and costs; doing otherwise undermines the intent of the business case and makes the above consequences likely.

Yet, business cases for many new programs are deficient. This is because there are strong incentives within the acquisition culture to overpromise a prospective weapon's performance while understating its likely cost and schedule demands. Thus, a successful business case is not necessarily the same as a sound one. Competition with other programs for funding creates pressures to overpromise. This culture is held in place by a set of incentives that are more powerful than policies to follow best practices. Moreover, the budget process calls for funding decisions before sufficient knowledge is available to make key decisions. Complementing these incentives is a marketplace characterized by a single buyer, low volume, and limited number of major sources. Thus, while it is tempting to describe the acquisition process as broken, it is more instructive to view it as in equilibrium: one in which competing forces consistently lead to starting programs with slim chances of being delivered on time and within cost.

Over the years, GAO has identified a number of reforms aimed at improving acquisition outcomes. Several of those are particularly relevant to changing the acquisition culture and will take the joint efforts of Congress and DOD:

- Ensure that new programs exhibit desirable principles before funding is approved.

- Identify significant program risks up front and allot sufficient resources.

- More closely align budget and program decisions.

- Mature technology before including it in product development.

- Develop system engineering and program manager capacity—sufficient personnel with appropriate expertise and skills.

Chairman Thornberry, Ranking Member Smith, and Members of the Committee:

I am pleased to be here today to discuss weapon systems acquisition reform. Weapon systems acquisition has been on GAO's high risk list since 1990.[1] Over the years, Congress and the Department of Defense (DOD) have explored ways to improve acquisition outcomes, including recent actions like the Weapon Systems Acquisition Reform Act of 2009 and the department's own "Better Buying Power" initiatives.[2] These and other reforms have championed sound management practices, such as realistic cost estimating, prototyping, and systems engineering. DOD's declining budgets and the impact of sequestration have lent additional impetus to reduce the costs of weapons. While some progress has been made on this front, too often we report on the same kinds of problems today that we did over 20 years ago.

Today, I will discuss (1) the performance of the current acquisition system; (2) the role of a sound business case in getting better acquisition outcomes; (3) systemic reasons for persistent problems; and (4) thoughts on actions DOD and Congress can take to get better outcomes from the acquisition process. This statement draws from our extensive body of work from 1990 until October 2015 on DOD's acquisition of weapon systems and the numerous recommendations we have made both on individual weapons and systemic improvements to the acquisition process. The work on which this testimony is based was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Problematic Acquisitions Continue

DOD has a mandate to deliver high-quality products to warfighters when they need them and at a price the country can afford. Quality and timeliness are especially critical to maintain DOD's superiority over

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[1]GAO, *High-Risk Series: An Update*, GAO-15-290 (Washington, D.C.: Feb. 11, 2015).

[2]Pub. L. No. 111-23, as amended.

others, to counter quickly changing threats, and to better protect and enable the warfighter.

U.S. weapons are the best in the world, but the programs to acquire them frequently take significantly longer and cost more money than promised and often deliver fewer quantities and capabilities than planned. It is not unusual for time and money to be underestimated by 20 to 50 percent. Considering that DOD is investing $1.4 trillion to acquire over 75 major weapon systems as of March 2015, cost increases of this magnitude have sizeable effects.[3] Typically, when costs and schedules increase, the buying power of the defense dollar is reduced. Consequences associated with this history of acquisition include:

- the warfighter gets less capability than promised;

- weapons perform well, but not as well as planned and are harder to support; and

- trade-offs made to pay for cost increases—in effect, opportunity costs—are not explicit.

This state of weapon acquisition is not the result of inattention. Many reforms have been instituted over the past several decades, but the above outcomes persist. DOD is in the midst of a series of "Better Buying Power" initiatives begun in June 2010 that have resulted in some improvements, but it is too early to assess their long term impact.[4]

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[3]GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-15-342SP (Washington, D.C.: March 12, 2015).

[4]Office of the Under Secretary of Defense, Acquisition, Technology and Logistics Memorandum: "Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending" (June 28, 2010). Office of the Under Secretary of Defense, Acquisition, Technology and Logistics Memorandum: "Better Buying Power 2.0: Continuing the Pursuit for Greater Efficiency and Productivity in Defense Spending" (Nov. 13, 2012). Office of the Under Secretary of Defense, Acquisition, Technology and Logistics Memorandum: "Better Buying Power 3.0 Achieving Dominant Capabilities through Technical Excellence and Innovation" (April 9, 2015).

GAO-16-187T

Key to Better Acquisition Outcomes: Better Business Cases

The decision to start a new program is the most highly leveraged point in the product development process. Establishing a sound business case for individual programs depends on disciplined requirements and funding processes. A solid, executable business case provides credible evidence that (1) the warfighter's needs are valid and that they can best be met with the chosen concept, and (2) the chosen concept can be developed and produced within existing resources—that is, proven technologies, design knowledge, adequate funding, and adequate time to deliver the product when it is needed. A program should not go forward into product development unless a sound business case can be made. If the business case measures up, the organization commits to the development of the product, including making the financial investment.

At the heart of a business case is a knowledge-based approach to product development that is both a best practice among leading commercial firms and the approach reflected in DOD's acquisition regulations. For a program to deliver a successful product within available resources, managers should demonstrate high levels of knowledge before significant commitments are made. In essence, knowledge supplants risk over time. Establishing a business case calls for a realistic assessment of risks and costs; doing otherwise undermines the intent of the business case and invites failure. This process requires the user and developer to negotiate whatever trade-offs are needed to achieve a match between the user's requirements and the developer's resources before system development begins. Key enablers of a good business case include:

- Firm, Feasible Requirements: requirements should be clearly defined, affordable, and clearly informed—thus tempered—by systems engineering; once programs begin, requirements should not change without assessing their potential disruption to the program.

- Mature Technology: science and technology organizations should shoulder the technology development burden, proving technologies can work as intended before they are included in a weapon system program. The principle here is not to avoid technical risk but rather take risk early and resolve it ahead of program start.

- Incremental, Knowledge-based Acquisition Strategy: rigorous systems engineering coupled with more achievable requirements are essential to achieve faster delivery of needed capability to the warfighter. Building on mature technologies, such a strategy provides time,

money, and other resources for a stable design, building and testing of prototypes, and demonstration of mature production processes.

- Realistic Cost Estimate: sound cost estimates depend on a knowledge-based acquisition strategy, independent assessments, and sound methodologies.[5]

Cultural Incentives Undermine Business Cases

An oft-cited quote of David Packard, former Deputy Secretary of Defense, is: "We all know what needs to be done. The question is why aren't we doing it?"

We need to look differently at the familiar outcomes of weapon systems acquisition—such as cost growth, schedule delays, large support burdens, and reduced buying power. Some of these undesirable outcomes are clearly due to honest mistakes and unforeseen obstacles. However, they also occur not because they are inadvertent but because they are encouraged by the incentive structure. It is not sufficient to define the problem as an objective process that is broken. Rather, it is more accurate to view the problem as a sophisticated process whose consistent results are indicative of its being in equilibrium. The rules and policies are clear about what to do, but other incentives force compromises. The persistence of undesirable outcomes such as cost growth and schedule delays suggests that these are consequences that participants in the process have been willing to accept. These undesirable outcomes share a common origin: decisions are made to move forward with programs before the knowledge needed to reduce risk and make those decisions is sufficient. There are strong incentives within the acquisition culture to overpromise a prospective weapon's performance while understating its likely cost and schedule demands. Thus, a successful business case—one that enables the program to gain approval—is not necessarily the same as a sound one.

Incentive to overpromise: The weapon system acquisition culture in general rewards programs for moving forward with unrealistic business cases. Strong incentives encourage deviations from sound acquisition practices. In the commercial marketplace, investment in a new product represents an expense. Company funds must be expended and will not

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[5]GAO, *GAO Cost Estimating and Assessment Guide*, GAO-09-3SP (Washington, D.C.: March 2009).

provide a return until the product is developed, produced, and sold. In DOD, new products represent revenue, in the form of a budget line. A program's return on investment occurs as soon as the funding decision is made.[6] Competition with other programs vying for defense dollars puts pressure on program sponsors to project unprecedented levels of performance (often by counting on unproven technologies) while promising low cost and short schedules. These incentives, coupled with a marketplace that is characterized by a single buyer (DOD), low volume, and limited number of major sources, create a culture in weapon system acquisition that encourages undue optimism about program risks and costs.

Program and Funding Decisions: Budget requests, Congressional authorizations, and Congressional appropriations are often made well in advance of major program decisions, such as the decision to approve the start of a program. At the time these funding decisions are made, less verifiable knowledge is available about a program's cost, schedule, and technical challenges. This creates a vacuum for optimism to fill. When the programmatic decision point arrives, money is already on the table, which creates pressure to make a "go" decision prematurely, regardless of the risks now known to be at hand.

Budgets to support major program commitments must be approved well ahead of when the information needed to support the decision is available. Take, for example, a decision to start a new program scheduled for August 2016. The new program would have to be included in the Fiscal Year 2016 budget. This budget request would be submitted to Congress in February 2015—18 months before the program decision review is actually held. It is likely that the requirements, technologies, and cost estimates for the new program—essential to successful execution— may not be very solid at the time of funding decisions. Once the hard-fought budget debates result in funds being appropriated for the program, it is very hard to take it away later, when the actual program decision point is reached.

To be sure, this is not to suggest that the acquisition process is foiled by bad actors. Rather, program sponsors and other participants act rationally

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[6]For the purposes of this report, "funding decisions" refers to appropriations acts, authorization acts, and the DOD budget process.

within the system to achieve goals they believe in. Competitive pressures for funding simply favor optimism in setting cost, schedule, technical, and other estimates.

Insufficient Business Cases Are Sanctioned by Funding Approvals: To the extent Congress approves funds for such programs as requested, it sanctions—and thus rewards—optimism and unexecutable business cases. Funding approval—authorizing programs and appropriating funds—is one of the most powerful oversight tools Congress has. The reality is once funding starts, other tools of oversight are relatively weak—they are no match for the incentives to overpromise.

So, if funding is approved for a program despite having an unrealistic schedule or requirements, that decision reinforces those characteristics instead of sound acquisition practices. Pressure to make exceptions for programs that do not measure up are rationalized in a number of ways: an urgent threat needs to be met; a production capability needs to be preserved; despite shortfalls, the new system is more capable than the one it is replacing; and the new system's problems will be fixed in the future. It is the funding approvals that ultimately define acquisition policy.

Recently, I testified before the Senate Armed Services Committee on the Ford Class Aircraft Carrier.[7] We reported in 2007 that ship construction was potentially underestimated by 22 percent, critical technologies were immature, and schedules were likely to slip. In other words, the carrier did not have a good business case. Nonetheless, funding was approved as requested. Today, predicted cost increases have occurred, the technologies have slipped nearly 5 years, and the program schedule has been delayed. Notably, the carrier represents a typical program without a good business case and its outcomes of cost increases and schedule delays are not unique. Funding approvals rewarded the unrealistic business case, reinforcing its success rather than that of a sound business case.

What to Do

Since 1990, GAO has identified a number of reforms aimed at improving acquisition outcomes. Several of those are particularly relevant to

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[7]GAO, *Ford Class Aircraft Carrier: Poor Outcomes are the Predictable Consequences of the Prevalent Acquisition Culture*, GAO-16-84T (Washington, D.C.: October 1, 2015).

changing the acquisition culture and will take the joint efforts of Congress and DOD.

Reinforce desirable principles at the start of new programs: The principles and practices programs embrace are determined not by policy, but by decisions. These decisions involve more than the program at hand: they send signals on what is acceptable. If programs that do not abide by sound acquisition principles receive favorable funding decisions, then seeds of poor outcomes are planted. The challenge for decision makers is to treat individual program decisions as more than the case at hand. They must weigh and be accountable for the broader implications of what is acceptable or "what will work" and be willing to say no to programs that run counter to best practices. The greatest point of leverage is at the start of a new program. Decision makers must ensure that new programs exhibit desirable principles before funding is approved. Programs that present well-informed acquisition strategies with reasonable and incremental requirements and reasonable assumptions about available funds should be given credit for a good business case. Every year, there is what one could consider a "freshman" class of new acquisitions. This is where DOD and Congress must ensure that they embody the right principles and practices, and make funding decisions accordingly.

Identify significant program risks upfront and resource them: Weapon acquisition programs by their nature involve risks, some much more than others. The desired state is not zero risk or elimination of all cost growth. But we can do better than we do now. The primary consequences of risk are often more time and money and unplanned—or latent—concurrency in development, testing, and production. Yet, when significant risks are taken, they are often taken under the guise that they are manageable and that risk mitigation plans are in place. Such plans do not set aside time and money to account for the risks taken. Yet in today's climate, it is understandable—any sign of weakness in a program can doom its funding. Unresourced risk, then, is the "spackle" of the acquisition system that enables the system to operate. This needs to change. If programs are to take significant risks, whether they are technical in nature or related to an accelerated schedule, these risks should be declared and the resource consequences acknowledged and provided. Less risky options and potential off-ramps should be presented as alternatives. Decisions can then be made with full information, including decisions to accept the risks identified. If the risks are acknowledged and accepted by DOD and Congress, the program should be supported.

<u>More closely align budget decisions and program decisions</u>: Requesting funding for programs 18 or so months ahead of when they will need it stems from a budgeting and planning process intended to make sure money is available in the future. Ensuring that programs are thus affordable is a sound practice. But, DOD and Congress need to explore ways to bring funding decisions closer in alignment with program decisions. This will require more thought and study. The alternative is that DOD and Congress will have to hold programs accountable for sound business cases at the time funding is approved, even if it is 18 months in advance of the program decision.

<u>Separate Technology Development from Product Development</u>: Leading commercial companies minimize problems in product development by separating technology development from product development and fully developing technologies before introducing them into the design of a system. These companies develop technology to a high level of maturity in a science and technology environment which is more conducive to the ups and downs normally associated with the discovery process. This affords the opportunity to gain significant knowledge before committing to product development and has helped companies reduce costs and time from product launch to fielding. Although DOD's science and technology enterprise is engaged in developing technology, there are organizational, budgetary, and process impediments which make it difficult to bring technologies into acquisition programs. For example, it is easier to move immature technologies into weapon system programs because they tend to attract bigger budgets than science and technology projects. Stronger and more uniform incentives are needed to encourage the development of technologies in the right environment to reduce the cost of later changes, and encourage the technology and acquisition communities to work more closely together to deliver the right technologies at the right time.

<u>Develop system engineering and program manager capacity</u>: Systems engineering expertise is essential throughout the acquisition cycle, but especially early when the feasibility of requirements are being determined, the technical and engineering demands of a design are being understood, and when an acquisition strategy for conducting production development is laid out. DOD has fallen short in its attempts to fill systems engineering positions.[8] These positions should be filled and their

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[8]GAO-15-290.

occupants involved and empowered early to help get programs on a good footing—i.e., a good business case—from the start. Program managers are essential to the success of any program. Program managers handed a program with a poor business case are not put in a position to succeed. Even with a good business case, program managers must have the skill set, business acumen, tenure, and career path to make programs succeed and be rewarded professionally. DOD has struggled to create this environment for program managers.

Concluding Remarks

Describing the current acquisition process as "broken" is an oversimplification, because it implies that it can merely be "fixed". The current process, along with its outcomes, has been held in place by a set of incentives—a culture—that has been resistant to reforms and fixes. Seen instead as a process in equilibrium, it is clear that changing it requires a harder, long-term effort by both DOD and Congress. There have been a number of recent reforms directed at DOD. Congress shares responsibility for the success of these reforms in the actions it takes on funding programs, specifically by creating enablers for sound business cases, and creating disincentives for programs that do not measure up.

Chairman Thornberry, Ranking Member Smith, and Members of the Committee, this concludes my statement and I would be happy to answer any questions.

GAO Contact and Staff Acknowledgements

If you or your staff has any questions about this statement, please contact Paul L. Francis at (202) 512-4841 or FrancisP@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are David Best, Assistant Director; R. Eli DeVan; Laura Greifner; and Alyssa Weir.

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Bio for Paul Francis

Current Position:	Managing Director, Acquisition and Sourcing Management, U.S. Government Accountability Office
Education:	Bachelor's degree in Accounting (University of Scranton) Masters Degree in Public Administration (George Washington University) Senior Executive Fellow, Kennedy School of Government
Work Experience:	Mr. Francis has been with GAO since June 1975, with most of his work experience being in the area of major weapon acquisitions. He has been a member of the Senior Executive Service since 2002. Since March 2009, he has led GAO's Acquisition and Sourcing Management team, which has responsibility for assessing the acquisition of weapon systems, services, NASA projects, and Coast Guard systems, as well as the execution of efforts to manage Federal contracting, acquisition workforce, and protection of critical technologies, He has previously conducted or been involved with reviews of many individual weapon programs, including Army helicopters, Future Combat Systems, unmanned aerial vehicles, tactical communications, shipbuilding programs, and missile defense. He has also conducted or been involved with cross-cutting reviews, several of which involved benchmarking with leading commercial firms and successful Department of Defense programs. These included acquisition culture, transition to production, technology maturation, requirements setting, supplier relationships, integrated product teams, requirements setting, training, test and evaluation, earned value management, milestone authorization, and affordability. He has also done work in the areas of wartime medical requirements and detection of landmines and unexploded ordnance. He has testified before congressional committees numerous times. Mr. Francis spent one year with the House Science and Technology Committee early in his career.

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OCTOBER 27, 2015

FOREIGN AFFAIRS

Published by the Council on Foreign Relations

Friday, December 6, 2013
Running the Pentagon Right
How to Get the Troops What They Need
Ashton B. Carter

ASHTON B. CARTER was U.S. Deputy Secretary of Defense from 2011 to 2013. From 2009 to 2011, he served as Undersecretary of Defense for Acquisition, Technology, and Logistics.

War inevitably presents unexpected challenges. From Germany's use of mustard gas during World War I to North Vietnam's surprisingly effective use of its air defense system during the Vietnam War, the United States has always faced unanticipated threats in combat that have required agile responses. U.S. troops on the ground continually adjust to changing enemy tactics with the capabilities they have at hand. Yet the part of the Defense Department that trains and equips those troops has rarely been as flexible.

This is a paradox that would surprise most people outside its walls: the Pentagon is ill equipped to address urgent needs that arise during wartime. The Department of Defense has a fairly good track record of making smart and deliberate long-term acquisitions, as evidenced by the substantial qualitative advantage the United States holds over any potential adversary. Although the department still struggles to contain the costs of military systems, it has come a long way in providing better buying power for the taxpayer. The Pentagon has also, by sad necessity, pioneered advances in medical technology, particularly in such areas as prosthetic limbs and the treatment of traumatic brain injuries and posttraumatic stress disorder.

But the same system that excels at anticipating future needs has proved less capable of quickly providing technology and equipment to troops on the battlefield. I have spent much of the past five years, first as undersecretary of defense for acquisition, technology, and logistics and then as deputy secretary of defense, trying to address this shortfall. With the Iraq war over and the war in Afghanistan coming to a close, it is important to understand what prevented the Pentagon from rapidly meeting immediate demands during those wars, what enduring lessons can be learned from its efforts to become more responsive, and how to put in place the right institutions to ensure success against future threats when agility is crucial.

PURCHASING POWERS

Introducing a new capability on the battlefield involves three main steps: deciding what is needed and selecting what to acquire from various alternatives, coming up with the money to pay for it, and fielding the capability (which includes delivering it to the troops and training them in how to use it). Over the course of the last decade, attempts to fast-track

each of these steps ran up against a number of obstacles, ultimately hindering the Pentagon's responsiveness to the needs of American forces on the ground.

At the outset of the wars in Afghanistan and Iraq, the Pentagon made two fatal miscalculations. First, it believed these wars would be over in a matter of months. Accordingly, since it normally takes years to develop new capabilities, the Pentagon saw little value in making acquisitions unique to the environments of Afghanistan and Iraq that would be irrelevant by the time they were ready. Second, the Pentagon was prepared for traditional military-versus-military conflicts -- a characterization that applied only to the early stages of the Iraq war. As a result, the military was not well positioned to fight an enemy without uniforms, command centers, or traditional organizational structures. The Pentagon initially failed to see the conflicts as requiring entirely new technologies and equipment, even as it became clear that improvised explosive devices (IEDs) and other makeshift tactics of an insurgency were more than nuisances -- they were strategic threats to U.S. objectives.

The unexpected length and nature of the wars -- particularly their evolution into protracted counterinsurgencies -- demanded materiel solutions that the Pentagon had not planned for. The usual process of writing "requirements," an exhaustive process to determine what the military needs based on an analysis of new technology and future threats, would not suffice in Afghanistan and Iraq. That is because the system known inside the Pentagon as "require then acquire" demands complete information: nothing can be purchased until everything is known.

Additionally, the division of labor between the military services and the combatant commands complicated the Pentagon's ability to fund urgent needs. The services generally focus their investments on future capability requirements, force structure, and modernization, whereas the combatant commands are charged with fighting today's wars with current equipment using funds primarily appropriated for operations, not for equipment development or procurement. There was essentially no structure within the department to bridge the gap between immediate and longer-term requirements.

Next came delays in funding. The Pentagon usually crafts its requests for funding as far as two years in advance. It must submit detailed budgets to Congress and then wait until the money has been authorized and appropriated before getting any program off the ground. This lengthy lag time makes it difficult to pay for urgent needs. Furthermore, the Pentagon has little flexibility to finance new needs that arise outside the budget cycle. Any significant movement of funds requires securing permission from Congress, which can take months. The process can also lead to an unproductive competition for resources within the Pentagon and around the country, where those whose money is transferred make their voices heard in protest.

The difficulties do not end as soon as Congress sets aside the money. To actually purchase anything, defense officials must navigate an intricate web of laws, regulations, and policies that are geared toward the acquisition of complex weapons systems and equipment in large quantities over years. The system was designed to foster fair competition among manufacturers and to maximize the buying power of taxpayers' dollars -- but not to move quickly. Moreover, the officials responsible for acquisitions are loath to take risks, since they can be held personally accountable if something goes wrong. So when balancing cost, performance, and schedule for major acquisition projects, the last is

often the least risky variable to compromise. The problem is that if an acquisition is necessary for the battlefield, every day of delay can risk the lives and safety of the troops.

Finally, in order to quickly field new capabilities, the Pentagon needed rapid contracting to transport the equipment and all the supplies and personnel necessary to sustain it. In landlocked Afghanistan, with primitive roads and few railways, this was especially challenging. The troops also had to be trained to use the new equipment in the field, since it did not exist when they were preparing for deployment.

"THE TROOPS ARE AT WAR, BUT THE PENTAGON IS NOT"

In 2004, the Pentagon, faced with dynamic enemies in Afghanistan and Iraq, finally realized that it needed a better way of doing business. That year, Paul Wolfowitz, then the deputy secretary of defense, formed the Joint Rapid Acquisition Cell, a collaborative body that ascertained the needs of troops on the battlefield from information provided by U.S. Central Command, which oversees both Afghanistan and Iraq, and facilitated the responses of the military services. JRAC acted as the focal point within the Department of Defense for prioritizing among different requirements, identifying solutions, and enabling the funding and fielding of new equipment.

Wolfowitz also expedited the usually slow and deliberate system for determining needs and allocating resources. He established the Joint Urgent Operational Needs process to fill gaps in the troops' capabilities across the services that, if left unaddressed, could threaten lives and combat missions. JRAC then helped identify funds and make sure the right equipment got to the battlefield by assigning a military service or agency as a sponsor. Nonetheless, as the wars ground on, it became clear that the normal system, even with JRAC facilitating a new requirements process, was neither responding fast enough to the needs of the combatant commands nor taking advantage of impressive new technologies. As Secretary of Defense Robert Gates later said, "The troops are at war, but the Pentagon is not."

One of the first emerging threats in Afghanistan and Iraq to highlight this weakness was the IED, a kind of crude homemade bomb that insurgents often placed alongside roads to target troops when they were most vulnerable. IEDs have caused more than 60 percent of U.S. combat casualties in the two wars. What makes them such a formidable weapon is that they are easy to construct and can be assembled with readily available commercial materials, such as fertilizer. They are also difficult to detect and easily disguised in the surrounding terrain, such as in trash heaps or even animal carcasses. Long before these wars, IEDs had become the weapon of choice for guerillas and terrorists from Northern Ireland to Chechnya, and their use in asymmetric warfare had been extensively studied. But the widespread availability of new technologies, such as wireless transmitters, electronic triggers, and longer-lasting batteries for detonators, rapidly increased their efficiency and potency in Afghanistan and Iraq. The sheer scope of their use in those wars caught the Pentagon off-guard and posed a grave risk to both campaigns, particularly since the American public's tolerance for casualties was tempered by expectations of short and easy wars.

In 2006, to better protect U.S. forces against this threat, then Deputy Secretary of Defense Gordon England, building on efforts in the army, established the Joint IED Defeat Organization (JIEDDO), which reported directly to him. Congress endorsed the idea and

appropriated over $22 billion to combat IEDs -- one of the few pockets of relatively flexible funding that legislators provided for rapid-response projects. Since then, JIEDDO has saved lives with such solutions as sensors that detect IEDs in the ground and electronic jammers that prevent their detonation. The organization has also covered the cost of critical counter-IED training for service members and, what is perhaps most valuable, funded the analysis of the enemy networks responsible for IED attacks, allowing U.S. forces to go on the offensive against what previously seemed a faceless threat.

JIEDDO helped double the number of counter-IED systems fielded by the Pentagon and cut in half the average amount of time it takes to get them to the battlefield. These efforts have contributed to lowering the rate of IED attacks that result in casualties by as much as 500 percent. And JIEDDO has helped reduce the severity of those IED attacks that do occur. By funding new protective undergarments, for example, JIEDDO made possible the roughly 32 percent drop from 2010 to 2011 in the number of catastrophic genital injuries to U.S. soldiers who were the victims of IEDs. At the Walter Reed medical center, I met the father of one soldier who had been wearing the undergarments when he stepped on an IED. The father approached me in the hallway, gave me a hug, and said, "My son will always have to use prosthetics to walk, but at least I still have a chance of being a grandfather."

Despite these significant successes, the increased attention and money provided by JIEDDO were not enough. Although the military deployed jammers and increased the armor on its Humvees, the insurgents found ways of building more effective IEDs, making U.S. vehicles and the troops inside them unacceptably vulnerable. Early on, field commanders had urged the creation of a new and more protective vehicle, but the perception within the Pentagon was that such a vehicle could not be funded and built before the wars ended and were thus unnecessary.

That skepticism was not limited to defense officials. In 2012, Vice President Joseph Biden recalled that when he was a senator, many of his colleagues on Capitol Hill opposed the development of an expensive counter-IED vehicle. He recounted one senator arguing that since the vehicles would not be needed once the wars were over, they were a total waste of money. Biden commented, "Can you imagine Franklin Roosevelt being told, 'We need x number of landing craft on D-Day, but once we land, we're not going to need them all again. So why build them?'"

It wasn't until 2007 that Gates decided -- at the urging of then Lieutenant General Raymond Odierno, commander of the Multinational Corps in Iraq -- to find a way to mitigate the threat to troops on the roads, regardless of the cost. Gates dubbed it "the highest-priority Department of Defense acquisition program" and immediately created a task force to accelerate the development and fielding of what became known as MRAPs: "mine-resistant, ambush-protected" vehicles. First led by John Young, who was undersecretary of defense for acquisition, technology, and logistics, and then by me when I served in that position, the MRAP Task Force was charged with taking "extraordinary steps" to cut through red tape, rally the defense industry, and deliver the vehicles.

With the support of Congress (including substantial flexible funding) and the attention of the most senior Pentagon officials, we decided to focus above all on getting MRAPs made quickly, accepting significant tradeoffs on less important parameters, such as the number of troops each could carry and their suitability for other kinds of conflicts. We considered

only mature technology and chose manufacturers based on their ability to deliver the vehicles as soon as possible. The task force anticipated and helped alleviate potential industry bottlenecks that could have held up the process -- for example, by paying to boost the production capacity of two tire-makers and by waiving regulations to allow the army to purchase specially hardened steel. The group also worked to standardize the vehicle's parts, such as turrets, jammers, and communications systems, across the various military services in order to expedite the fielding while also building a flexible design that could accommodate upgrades and improvements.

As a result of these efforts, we were able to build and ship more than 11,500 MRAPs to Iraq in 27 months and to build more than 8,000 all-terrain MRAPs for Afghanistan in only 16 months. Ultimately, we sent more than 24,000 MRAPs to the two theaters of war -- the largest defense procurement program since World War II to go from decision to full industrial production in less than a year. Not only did these vehicles save thousands of lives; they also showed just how much can be accomplished with the full backing of leaders in Congress and the administration.

Task forces became the model of choice to address needs that could be met only outside the traditional processes. Another example of their effective use was for intelligence, surveillance, and reconnaissance (ISR) capabilities. The Department of Defense had well-established procedures for managing and allocating the ISR capabilities it had already developed, but it had limited experience in rapidly developing and fielding new ISR capabilities, especially down to the tactical level. To do so required thinking of aerostats and unmanned aircraft as consumable goods, more like body armor than satellites -- that is, seeing them as tools that could be fielded quickly and operated by units in the field rather than by the intelligence agencies. Gates thus established the ISR Task Force in 2008, which successfully helped identify emerging urgent needs and technological opportunities and then bypass the normal roadblocks to procuring and fielding the resulting ISR tools.

Task forces worked well for specific individual problems, but few problems in wartime are narrowly defined, since military conflicts erase the boundaries between previously separate issues. Gates thus became frustrated with the Pentagon's inability to support the troops through the normal processes. Accordingly, in November 2009, he created the Counter-IED Senior Integration Group (SIG), which I headed alongside the director of operations for the Joint Chiefs of Staff. The group consisted of senior defense officials who met every three weeks to prioritize requirements and take stock of all counter-IED initiatives. Gates soon realized that this kind of high-level attention was needed for all urgent war-fighting requirements, not just counter-IED measures. So in June 2011, he converted the Counter-IED SIG into the Warfighter SIG, which became the Pentagon's central body for senior officials to weigh solutions to battlefield problems, locate the necessary resources to pay for them, and make the right acquisitions.

Gates soon expanded the Warfighter SIG's mandate further, to include what are called Joint Emergent Operational Needs. These are needs that arise in theaters where there are not ongoing wars but one could come at any moment, such as on the Korean Peninsula. We called the whole system of Joint Emergent Operational Needs and Joint Urgent Operational Needs "the fast lane." Even when the precise cost and ultimate specifications of a fast-lane project couldn't be fully known in advance, we got started anyway, standing the system on its head. In other words, instead of "require then acquire," this was

"acquire then require."

According to a 2012 Government Accountability Office report, the heightened level of visibility within the Pentagon provided by the Warfighter SIG, together with the fast-lane process, decreased the median time needed to locate funding for projects from nine months to one month. The report found that initiatives that enjoyed attention from the top of the department were four times as likely to receive adequate funding as those that did not. The system is far from perfect, but it has injected some badly needed agility into the Pentagon's notoriously slow bureaucracy.

THE NEED FOR FLEXIBILITY

The challenge for the Pentagon now is to lock in these gains and make sure that the lessons of Afghanistan and Iraq are not forgotten. The clearest takeaway, as the Warfighter SIG has shown, is that wartime acquisition works best when senior leaders are paying attention. That's because only top officials can assume the risks that come with sidestepping general procedures. In practice, this means that the upper echelons of the department cannot simply issue policy guidance; they need to focus on specific threats and capability gaps. They must be willing to do so even when the projects are small in size and scope compared with the issues they normally deal with, given that winning wars and saving lives are at stake.

Furthermore, there must be a structure to the way senior officials grant their time and attention to such projects. Methods that bypass the normal acquisition process cannot be sustained if they rely solely on the support of a particular individual. And even the best ideas will remain unrealized if there are not clear procedures for bringing them to fruition -- especially in the Department of Defense, which thrives on order and discipline. At the very least, the department ought to retain the nascent institutions that ultimately proved successful in Afghanistan and Iraq, such as the Warfighter SIG and JRAC.

Of course, the Pentagon cannot acquire any equipment or technology without adequate funding. And the current budget process simply does not allow for the development and deployment of solutions to urgent problems on the battlefield. The Department of Defense has developed several mechanisms for addressing such needs, and it must keep all of them in place.

First, Congress should continue to approve funds in limited quantities for general overall goals, such as the funds that paid for the MRAPs and other counter-IED initiatives, a process that offers the military the necessary flexibility to get capabilities from the laboratory all the way to the battlefield. The authority for this approach currently exists but is set to expire in 2015.

The ability to rapidly move a small percentage of the defense budget -- known in the Pentagon as "reprogramming" -- has allowed the department to pay for many capabilities not covered by a specific fund. Reprogramming enables crucial projects to move forward in weeks and months, rather than years, while still preserving Congress' role in approving funding. Another key tool that the Pentagon must retain is its congressionally authorized "rapid-acquisition authority," which allows the secretary of defense to repurpose up to $200 million a year from the $500 billion defense budget for the most urgent needs. Congress could help bolster the Pentagon's quick-reaction capabilities by expanding the scope of allowed acquisitions and increasing the funding available under this authority.

In this era of tight resources, some in Congress have legitimate concerns about giving the Department of Defense more budgetary discretion. However, the amount needed for an effective flexible fund is a tiny fraction of the department's total budget -- just enough to kick-start urgent initiatives while still taking the customary months to navigate the usual channels for the full funding of projects. The Pentagon's successful management of previous flexible funds demonstrates its ability to responsibly manage this flexibility.

Even with flexible funds and the right structures in place, the Pentagon also needs to get better at identifying threats as early as possible. This does not mean war-gaming for five to ten years down the line -- something the department currently does in its Quadrennial Defense Reviews. Rather, it means determining what troops in the field need at any given moment. Staff at the command or headquarters level are often slow to recognize when a new threat becomes truly dangerous. During a war, the Pentagon must continuously scan the tactical environment and analyze how new dynamics impact the campaign. Initiatives such as the Warfighter SIG create a real-time bridge between ground-level troops and the department's senior leadership, allowing battlefield challenges to be quickly brought to the attention of the highest levels so that they can execute solutions accordingly. One example was the rapid processing of a Joint Urgent Operational Need to design and deploy a new type of body armor, based on insights from the ground, to correct for a battlefield vulnerability before insurgents were even aware of it. Another was the constant adjustment of MRAPs in response to feedback from troops. No detail, even the positioning of windows, was too small for the Warfighter SIG.

Moreover, the Pentagon must always have a watchful eye on the horizon, anticipating needs and gaps in capabilities before they become dire. These findings should drive rapid research and development, particularly experimentation with new or improved technologies and the building of prototypes. Investing in science and technology early on ensures that the Pentagon will have something on the shelf when it needs it, so that it does not have to start from scratch when it is too late. Technology that the Pentagon has already invested in has allowed it to respond rapidly through the Joint Emergent Operational Needs process to potential new threats in the Middle East and Asia. These technologies include improvements to weapons systems that allow them to operate in an electronically jammed environment, modified radars to improve detection and warning capabilities, and better methods of preventing electronic detection by enemies. Similarly, the department was able to quickly initiate the development of improvements to the Patriot missile defense system to keep pace with emerging threats in the Asia-Pacific region.

Once the Pentagon identifies emerging threats, its leaders need to approve responses to them, since those in the thick of combat cannot be expected to have all the insight needed to judge and prioritize requests. Time is of the essence at this stage; the need for the MRAP, for example, was identified by forces in the field soon after they started encountering roadside bombs, but leaders let the request linger for too long before acting on it. As soon as a need has been identified as urgent, the Pentagon must improve the way it assesses potential solutions. Normally, such evaluations require a series of time-consuming steps, such as conducting market surveys, hosting events at which the military can inform vendors of its needs, requesting bids, and conducting months-long selection processes. In normal times, this system allows the Pentagon to acquire the best technologies on the market at the best prices. In urgent situations, it will have to settle for something that is good enough -- an imperfect solution that nonetheless fills a gap.

KEEPING UP WITH A CHANGING BATTLEFIELD

Afghanistan and Iraq provided much of the impetus for the Pentagon to sidestep its traditional ways of doing business. After all, it is difficult for anyone in Washington to deny funding or prevent initiatives when the men and women at war need them. But what happens when the last troops have left Afghanistan, and the slowness of the acquisition process no longer appears to be a life-and-death problem? Simply learning the lessons of the wars is not enough; the Pentagon must institutionalize those lessons so that it does not have to start anew the next time they are relevant. In fact, many of these changes need to happen immediately, as the country faces potential new threats.

In my final year at the Pentagon, under the leadership of Leon Panetta and then Chuck Hagel, we considered various models for how to build on the successful initiatives of the past decade. The first possibility we considered was to tweak, but largely leave in place, the way the Pentagon operated before the wars in Afghanistan and Iraq, with the military services remaining solely responsible for their own forces. That approach would allow the Pentagon to avoid creating any new permanent organizations, a significant plus during a time of austerity. Distributing responsibility across the services would also enable each of them to draw on their deep knowledge of land, air, and naval warfare. The downside is that the military services tend to prioritize investments in their own long-term modernization requirements -- unlike the combatant commands, which are primarily concerned with immediate battlefield needs -- and thus may not be best equipped to move quickly and take risks. Under this plan, there would still not be a clear mechanism for adjudicating conflicts between the services and the combatant commands. Spreading the responsibility for acquisitions across the military could also result in redundancies or gaps.

An alternative model would be to create an entirely new agency with rapid-acquisition and contracting authorities. Such a body would directly support the combatant commands by anticipating battlefield needs, determining the appropriate responses, and procuring the necessary technology and equipment. Although this approach would correct for many of the shortfalls of the first model, creating a brand new organization, with its own bureaucracy and overhead costs, would strain the Pentagon in an era of tight budgets. A new centralized agency might also find itself disconnected from the rich expertise of the military services.

We ultimately decided to pursue a hybrid approach that draws on the advantages of both models. The Warfighter SIG will continue to meet regularly, supported by JRAC, to ensure that the Pentagon's senior leadership remains focused on responding quickly to battlefield needs. JIEDDO and the ISR Task Force will get smaller but will be retained to meet the Pentagon's enduring requirement for fulfilling urgent needs. The comptroller's office is also working to institutionalize funding mechanisms for both Joint Urgent Operational Needs and Joint Emergent Operational Needs. These mechanisms should allow department leaders to quickly reprogram funds and make use of the rapid-acquisition authority.

By making these structures more permanent, the Pentagon hopes to retain the ability to meet the urgent needs of the troops long after the end of operations in Afghanistan. It is already using the Joint Emergent Operational Needs process to upgrade munitions and targeting systems for operations over water, in order to respond to the potential use of speedboats by Iran to swarm U.S. naval vessels in the Persian Gulf. The military has also

developed and built prototypes for improvements to a penetrating bomb that would allow it to target hardened, deeply buried facilities. And last year, the Department of Defense decided to build the Field Deployable Hydrolysis System, a transportable system that can destroy chemical weapons stockpiles wherever they are found. This system was developed as part of the Joint Emergent Operational Needs process months before the United States knew it would be discussing the destruction of Syria's chemical weapons. It is now ready for deployment whenever required -- a capability that enabled the U.S. government to include this possibility in its recent UN negotiations.

Institutionalizing these practices will also allow them to be applied beyond Central Command, which has overseen most of the fighting during the past decade -- a particularly relevant factor as the Obama administration continues its "rebalance" to the Asia-Pacific region and focuses more on threats from other parts of the world, such as Africa. For example, JIEDDO has already begun to support missions of U.S. Africa Command, and its expertise will help combat IED threats in such countries as Mali and Somalia.

When wars end, leaders are often eager to move on to the next challenge. That is why it is crucial to make permanent the institutional innovations resulting from the hard-earned lessons of Afghanistan and Iraq, while the experiences are still fresh. Too many lives were lost in the early years of those wars because the Pentagon failed to keep up with a changing battlefield. Never again should it make the same mistake.

ENCLOSURE 13

RAPID FIELDING OF CAPABILITIES

1. PURPOSE. This enclosure provides policy and procedure for acquisition programs that provide capabilities to fulfill urgent operational needs and other quick reaction capabilities that can be fielded in less than 2 years and are below the cost thresholds of Acquisition Category (ACAT) I and IA programs.

2. URGENT OPERATIONAL NEEDS AND OTHER QUICK REACTION CAPABILITIES

   a. DoD's highest priority is to provide warfighters involved in conflict or preparing for imminent contingency operations with the capabilities urgently needed to overcome unforeseen threats, achieve mission success, and reduce risk of casualties, as described in DoD Directive 5000.71 (Reference (cc)). The objective is to deliver capability quickly, within days or months. DoD Components will use all available authorities to expeditiously fund, develop, assess, produce, deploy, and sustain these capabilities for the duration of the urgent need, as determined by the requesting DoD Component. Approval authorities for each acquisition program covered by this enclosure will be delegated to a level that promotes rapid action.

   b. This enclosure applies to acquisition programs for the following types of quick reaction capabilities:

      (1) A validated Urgent Operational Need (UON). UONs include:

         (a) Joint Urgent Operational Needs (JUONs) and Joint Emergent Operational Needs (JEONs). These are either an urgent need identified by a Combatant Commander, the Chairman of the Joint Chiefs of Staff (CJCS), or the Vice Chairman of the Joint Chiefs of Staff (VCJCS) involved in an ongoing contingency operation (i.e. a JUON) or an emergent need identified by a Combatant Commander, CJCS, or VCJCS for an anticipated or pending contingency operation (i.e. a JEON). For JUONs and JEONs, the validation approval will be by the Joint Staff in accordance with the Joint Capability Integration Development System (JCIDS) detailed in the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01H (Reference (d)). Program execution for JUONs and JEONs will be assigned in accordance with DoD Directive 5000.71. The Milestone Decision Authority (MDA) for JUONs and JEONs will be determined at the DoD Component level except in very rare cases when the MDA will be designated in an Acquisition Decision Memorandum (ADM) by the Defense Acquisition Executive (DAE).

         (b) DoD Component-specific UON. These are defined in CJCSI 3170.01H and further discussed in DoD Directive 5000.71. Approval authorities for DoD Component UONs, including their validation, program execution, and the designation of the MDA, will be at the DoD Component level.

(2) <u>A Warfighter Senior Integration Group (SIG)-Identified Urgent Issue</u>. This is a critical warfighter issue, e.g. materiel support to a coalition partner, identified by the Co-Chairs of the Warfighter SIG in accordance with DoD Directive 5000.71. The Co-Chairs of the Warfighter SIG will approve a critical warfighter issue statement and provide instructions to DoD Component(s) on program execution and management.

(3) <u>A Secretary of Defense Rapid Acquisition Authority (RAA) Determination</u>. This is a Secretary of Defense signed determination that is made in response to a documented deficiency following consultation with the Joint Staff. RAA should be considered when, within certain limitations, a waiver of a law, policy, directive, or regulation will greatly accelerate the delivery of effective capability to the warfighter in accordance with section 806(c) of P.L. 107-314 (Reference (i)).

3. <u>PROCEDURES</u>

a. MDAs and program managers will tailor and streamline program strategies and oversight. This includes program information, acquisition activity, and the timing and scope of decision reviews and decision levels. Tailoring and streamlining should be based on program complexity and the required timelines to meet urgent need capability requirements consistent with applicable laws and regulations.

b. DoD Components will employ, to the extent possible, parallel rather than sequential processes to identify and refine capability requirements, identify resources, and execute acquisitions to expedite delivery of solutions. Formal milestone events may not be required. Acquisition decision making and associated activity will be tailored to expedite acquisition of the capability. Development will generally be limited, and the MDA can authorize production at the same time development is approved.

c. DoD Components will ensure that financial, contracting, and other support organizations (e.g., Defense Contract Audit Agency, Defense Contract Management Agency, General Counsel) and prime and subcontractors involved with aspects of the acquisition program are fully aware of the urgency of the need and will ensure expedited action.

d. Generally, funds will have to be reprioritized and/or reprogrammed to expedite the acquisition process. If a capability can be fielded within an acceptable timeline through the normal Planning, Programming, Budgeting, and Execution System, it would not be considered appropriate for rapid acquisition.

e. Consistent with the emphasis on urgency, if the desired capability cannot be delivered within 2 years, the MDA will assess the suitability of partial or interim capabilities that can be fielded more rapidly. In those cases, the actions necessary to develop the desired solution may be initiated concurrent with the fielding of the interim solution. Critical warfighter issues identified by the Warfighter SIG, per DoD Directive 5000.71 (Reference (cc)), will be addressed as determined by the Co-Chairs of the Warfighter SIG.

4. RAPID ACQUISITION ACTIVITIES. The following paragraphs describe the main activities associated with the Rapid Fielding of Capabilities: Pre-Development, Development, Production and Deployment (P&D), and Operations and Support (O&S). The activities detailed in this enclosure are not separate from or in addition to activities performed as part of the acquisition system but are a highly tailored version of those activities and are intended to expedite the fielding of capability by tailoring the documentation and reviews normally required as part of the deliberate acquisition process. Figure 10 depicts a representative acquisition.

<p align="center">Figure 10. Rapid Fielding of Capabilities</p>
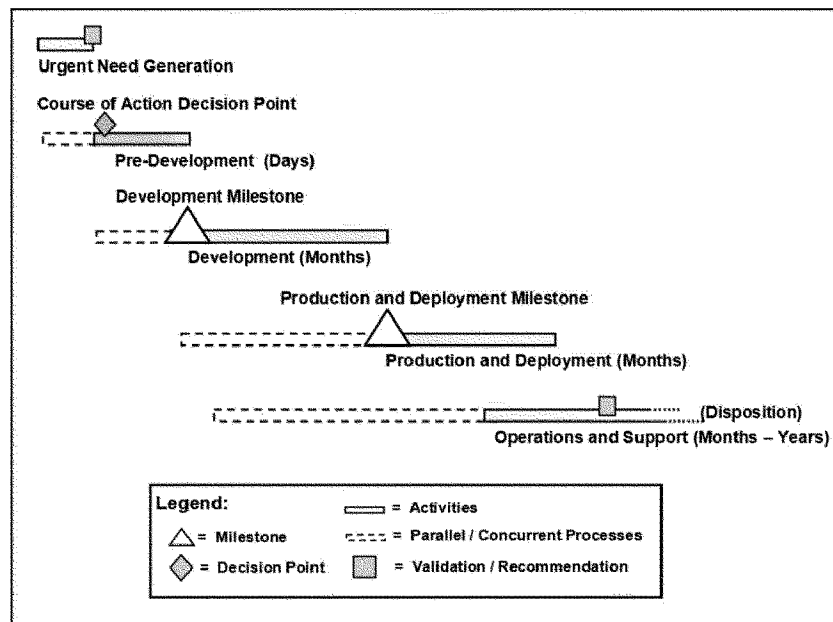
a. Pre-Development

(1) Purpose. The purpose of Pre-Development is to assess and select a course or courses of action to field a quick reaction capability and to develop an acquisition approach.

(2) Initiation. Pre-Development begins upon receipt of either a validated UON, approval of a critical warfighter issue statement by the co-chairs of the Warfighter SIG per DoD Directive 5000.71, or a Secretary of Defense RAA determination document, where the associated

<p align="center">145   ENCLOSURE 13</p>

documentation serves as the justification to continue the action until such time as the disposition action discussed in paragraph 4e(5) of this enclosure.

    (3) <u>Pre-Development Activities</u>

        (a) Upon Pre-Development initiation, the designated Component Acquisition Executive (CAE) will immediately appoint a Program Manager and an MDA. If the DAE has retained MDA authority, he or she will either appoint a Program Manager or task a CAE to do so.

        (b) The Program Manager in collaboration with the intended user and the requirements validation authority:

        <u>1</u>. Assesses the required capability and any recommended non-materiel options and, if not adequately stated, determines the performance thresholds for the minimal set of performance parameters required to mitigate the capability gap.

        <u>2</u>. Performs an analysis of potential courses of action, if not already performed, that considers:

        <u>a</u>. The range of feasible capabilities, near, mid, and/or long term, to include consideration of an existing domestic or foreign-made system.

        <u>b</u>. The acquisition risk (cost, schedule, and performance) and the operational risk of each solution.

        <u>c</u>. The operational risk to the requesting Commander if an effective solution is not deployed in the time specified by the Commander.

        <u>3</u>. Presents a recommended course of action for review and approval by the MDA.

        <u>4</u>. If the Program Manager is unable to identify an effective solution, the Program Manager will notify the MDA. The MDA will in turn notify the DoD Component validation authority. If it is a JUON or JEON, a critical warfighter issue identified by the Warfighter SIG, or a Secretary of Defense RAA Determination, the MDA will notify the DAE and the requirements validation authority through the Director, Joint Rapid Acquisition Cell (JRAC), and the Deputy Director of Requirements, Joint Staff.

        (c) The Program Manager will present the recommended course(s) of action to the MDA and the requirements validation authority. The selected course of action will be documented in an ADM. More than one course of action may be selected to provide the phased or incremental fielding of capabilities.

        (d) For each approved course of action, the Program Manager will develop a draft Acquisition Strategy and an abbreviated program baseline based on readily available

information. In the context of this enclosure, the documentation requirement is for the minimal amount necessary to define and execute the program and obtain MDA approval. This documentation may take any appropriate, written form; will typically be coordinated only with directly affected stakeholders; and will evolve in parallel with rapid acquisition activities as additional information becomes available as a result of those activities.

(e) The Acquisition Strategy will comply with the requirements in Table 10 of this enclosure and the items in Table 2 of Enclosure 1 that are required for ACAT II and III programs (unless modified by Table 10); however, a streamlined, highly tailored strategy consistent with the urgency of the need will be employed. Regulatory requirements will be tailored or waived. The tailored Acquisition Strategy should be relatively brief and contain only essential information, such as resourcing needs and sources, key deliverables, performance parameters, key risks and mitigation approaches, a production schedule, a contracting methodology and key terms, preliminary plans for assessment (which may or may not include test and evaluation (T&E)), deployment, training, and sustainment. Information technology (IT), including National Security Systems (NSS), provided in response to an urgent need require an Authority to Operate in accordance with DoD Instruction 8510.01 (Reference (bg)). A disposition decision should be made as early as feasible and decided upon at appropriate milestones or other decision points.

(f) Funding for the acquisition program may be in increments over the program's life cycle. The program life cycle begins upon Pre-Development initiation and ends upon completing the final disposition of the capability as described in the O&S portion of this enclosure.

(g) When designing the Acquisition Strategy, the Program Manager, in collaboration with the requesting operational commander or sponsoring user representative will determine whether an operational prototype is necessary and include this determination in the Acquisition Strategy.

(h) If the program has been placed on Director, Operational Test and Evaluation, (DOT&E) oversight, a plan for operational testing must be approved by the DOT&E. DOT&E will report the results of required testing to the Secretary of Defense and provide copies to Congress and the MDA.

b. <u>Development Milestone</u>. Entry into Development is approved by the MDA.

(1) The Program Manager will provide the Acquisition Strategy and Program Baseline to include the program requirements, schedule, activities, program funding, and the assessment approach and intermediate decision points and criteria as the basis for this decision.

(2) The MDA will:

(a) Determine the feasibility of fielding the capability within the required timelines to include consideration of the technical maturity of the preferred solution(s).

(b) Review the Acquisition Strategy and Program Baseline and determine whether the preferred solution(s):

    1. Can be fielded within 2 years.

    2. Does not require substantial development effort.

    3. Is based on technologies that are proven and available.

    4. Can be acquired under a fixed price contract.

(c) Provide any exceptions necessary pursuant to section 804 (b)(3) of P.L. 111-383 (Reference (m)), including exceptions to the requirements of paragraphs 4b(2)(b)1 through 4b(2)(b)4.

(d) Approve initial quantities to be produced and assessed (to include required assessment and training articles).

(e) Approve the tailored Acquisition Strategy and Acquisition Program Baseline. These documents will be based on available information to be updated over time as directed by the MDA.

(f) Decide if RAA, in accordance with section 806(c) of P.L. 107-314 (Reference (i)), should be requested from the Secretary of Defense to expedite the fielding of the capability.

(g) Approve the planned testing approach. A normal Test and Evaluation Master Plan (TEMP) is generally not necessary. TEMPs are usually not appropriate for rapid acquisitions when there is minimal development work and minimal T&E to execute. Some test planning is usually required, however. In collaborate with the supporting operational test organization, a highly tailored and abbreviated test plan may be required by the MDA. The abbreviated test plan will describe a performance assessment approach that will include schedule, test types and environment, and assets required. An Operational Test Plan for the required pre-deployment performance assessment is generally adequate. If the defense rapid acquisition program is on DOT&E oversight, a TEMP is also not normally required; however, the Program Manager should prepare a combined operational and live fire test plan for DOT&E approval.

(h) Approve any appropriate waivers to statute or regulation. Specify any additional authority the Program Manager may use to modify the acquisition approach without the specific approval of the MDA.

(i) Authorize release of the request for proposals and related documents for development and any other MDA approved actions.

(j) Document these decisions in an ADM.

c. Development Activities

(1) Development includes an assessment of the performance, safety, suitability, and survivability of the capability, but does not require that all identified deficiencies including those related to safety be resolved prior to production or deployment. The MDA will, in consultation with the user and the requirements validation authority, determine which deficiencies must be resolved and what risks can be accepted.

(2) IT, including NSS, fielded under this enclosure require an Authority to Operate in accordance with DoD Instruction 8510.01 (Reference (bg)). DoD Component Chief Information Officers will establish processes consistent with DoD Instruction 8510.01 for designated approval authorities to expeditiously make the certification determinations and to issue Interim Authorization to Test or Authority to Operate.

d. P&D Milestone

(1) Entry into P&D is approved by the MDA.

(2) At the P&D Milestone review:

(a) The Program Manager will summarize the results of Development activity and the program assessment to date. The Program Manager will present plans to transport, deploy, and sustain the capability; to conduct Post-Deployment Assessments; and to train maintenance and operating personnel. This information will be provided to the MDA for approval.

(b) The MDA, in consultation with the supporting operational test organization, and with the concurrence of DOT&E for programs on DOT&E oversight, will determine:

1. Whether the capability has been adequately reviewed, performs satisfactorily, is supportable, and is ready for production and deployment.

2. When assessments of fielded capabilities are required.

(c) The MDA decides whether to produce and, in coordination with the requester/user, deploy (field) the system, approves the updated Acquisition Strategy (which will include the sustainment plan) and Program Baseline, and documents the Production Decision in an ADM.

(3) P&D Activities

(a) During P&D the acquiring organization provides the warfighter with the needed capability, to include any required training, spares, technical data, computer software, support equipment, maintenance, or other logistics support necessary for operation.

        <u>1</u>. DoD Components will ensure that the capability and required support (e.g., field service representatives, training) are deployed by the most expeditious means possible and tracked through to their actual delivery to the user.

        <u>2</u>. The DoD Components will coordinate with each other and the requiring activity to verify the total number of items required, considering necessary support and spares and training assets for deployed and/or pre-deployment training.

    (b) Upon deployment, the capability will enter O&S.

e. <u>O&S</u>

    (1) The Program Manager will execute a support program that meets materiel readiness and operational support performance requirements, and sustains the capability in the most cost-effective manner over its anticipated total life cycle. Planning for O&S will begin during Pre-Development and will be documented in the Acquisition Strategy.

    (2) The capability is operated and supported consistent with the sustainment plan approved by the MDA at the Production Milestone.

    (3) The Program Manager or the user may propose urgently needed improvements to the capability. If within the scope of the initial requirements document, procedures in this enclosure may be used to acquire the improvements. If improvements are outside the scope of the validated or approved requirements document, a new or amended requirements document may be required.

    (4) In collaboration with the original requesting DoD Component, a post-deployment assessment will be conducted after deployment. If practical, this assessment will be conducted in the field by the supporting operational test organization. If not practical, the Program Manager may use alternate means for this assessment to include Program Manager or operational test agency assessment of user feedback or other DoD Component feedback. Post-deployment assessment approaches for all programs under DOT&E Oversight will be independently reviewed and approved by DOT&E.

    (5) <u>Disposition Analysis</u>. No later than 1 year after the program enters O&S (or earlier if directed by the DoD Component), the DoD Component will appoint an official to conduct a Disposition Analysis. Based on the analysis, the DoD Component head and the CAE will prepare a determination document for disposition of the system. The disposition analysis will consider the performance of the fielded system, long term operational needs, and the relationship of the capability to the Component's current and planned inventory of equipment. The analysis will also consider the continuation of non-materiel initiatives, the extension of science and technology developments related to the fielded capability, and the completion of MDA-approved and funded materiel improvements. The disposition official will recommend one of the following options:

(a) <u>Termination: Demilitarization or Disposal</u>. The system will be demilitarized and disposed of in accordance with all legal and regulatory requirements and policy related to safety (including explosive safety) and the environment. The recommendation will be coordinated with the DoD Component or, for JUONs and JEONs, the Combatant Commands.

(b) <u>Sustainment for Current Contingency</u>. Operation and sustainment of the system will continue for the current contingency. Multiple sustainment decisions may be made should the system require operations and support longer than 2 years; however, such sustainment decisions will be made and re-documented at least every 2 years. The sustained system will continue to receive the same priority of action as the original acquisition program. This recommendation will be coordinated with the DoD Component validation authority.

(c) <u>Transition to Program of Record</u>. If the system provides a needed, enduring capability, it may be transitioned to a program of record. The disposition official will recommend to the CAE the acquisition point of entry into the defense acquisition system, and whether the MDA should retain program authority or whether it should transition elsewhere. The requirements validation authority will specify the capability requirements documents required to support transition to a new or existing program of record. The disposition recommendation will be made to the DoD Component head for UONs, critical warfighter issues identified by the Warfighter SIG, or Secretary of Defense RAA determinations.

(6) The DoD Component head and the CAE will review the disposition official's recommendation and record the Component head's transition decision in a Disposition Determination. The Determination will specify the requirements documents required by the validation authority to support the transition. Programs of record will follow the procedures for such programs described in this instruction.

5. <u>ADDITIONAL INFORMATION REQUIREMENTS</u>. Table 10 provides the Information Requirements that replace or are in addition to the statutory or regulatory requirements in Tables 2 and 6 in Enclosure 1 that are applicable to ACAT II and ACAT III programs. For rapid acquisition, the documentation procedures described in paragraph 4a(3)(d) will be applied to all information requirements unless otherwise prescribed in statute.

Table 10. Information Requirements Unique to the Urgent Needs Rapid Acquisition Process

INFORMATION REQUIREMENT	RAPID ACQUISITION DECISION EVENTS		SOURCE
	Development	Production	
STATUTORY REQUIREMENTS			
ASSESSMENT APPROACH	●	●	10 U.S.C. 2366 (Ref. (g)) 10 U.S.C. 2399 (Ref. (g))
STATUTORY; only required for programs responding to urgent needs. - For programs on Director, Operational Test and Evaluation (DOT&E) oversight, combined operational and live fire test plans will be submitted to DOT&E at the Development Milestone, and post-deployment assessment plans at the Production and Deployment Milestone. DOT&E will ensure that testing is tailored to rapidly evaluate critical operational issues. - Programs not on DOT&E oversight are approved at the Service level; the program may require a rapid and focused operational assessment and live fire testing (if applicable) prior to deploying an urgent need solution. The Acquisition Approach will identify any requirements to evaluate health, safety, or operational effectiveness, suitability, and survivability.			
COURSE OF ACTION ANALYSIS	●		Meets the assessment requirements of Subtitle III, Title 40, United States Code (Reference (p)) (see Table 9 in Enclosure 1). (Ref. (p))
STATUTORY, replaces and serves as the AoA. Approved by the MDA. For JUONs, JEONs, critical warfighter issues identified by the Warfighter SIG, and Secretary of Defense RAA determinations, a copy is due to the Director, JRAC, within 3 business days of MDA approval.			
RAPID ACQUISITION AUTHORITY (RAA) RECOMMENDATION	●		SEC. 806, P.L. 107-314 (Ref. (i))
STATUTORY. Optional request to the Secretary of Defense for RAA. Considered as part of the development of the Acquisition Strategy. MDA approves the decision to request RAA at the Development Milestone.			
REGULATORY REQUIREMENT			
Disposition Authority's Report to the DoD Component Head			Para. 4e(5) of this enclosure
Regulatory. Based on the disposition official's recommendation in the Disposition Analysis, the Component Head will determine and document the disposition of the initiative and process it in accordance with applicable Component and requirements authority procedures. Due within 1 year of entering the Operations and Support Phase (or earlier, if directed).			
Table Notes: 1. A dot (●) in a cell indicates the specific applicability of the requirement to the life-cycle event 2. Documentation required for the identified events will be submitted no later than 45 calendar days before the planned review. 3. While these requirements are specific to programs responding to urgent needs, they are additive to the requirements identified in Tables 2 and 6 in Enclosure 1.			

ENCLOSURE 13

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

OCTOBER 27, 2015

RESPONSE TO QUESTION SUBMITTED BY MS. SPEIER

Mr. FRANCIS. The decision to start a new program is the most highly leveraged point in the product development process. Establishing a sound business case for individual programs depends on disciplined requirements and funding processes. Key enablers of a good business case include: firm, feasible requirements, mature technology, incremental, knowledge-based acquisition Strategy, and realistic cost estimates.

Every year, there is what one could consider a "freshman" class of new acquisitions. This is where DOD and Congress must focus to ensure that programs embody the right principles and practices and make funding decisions accordingly. Congress will need to focus on oversight of programs in the President's Budget projected to begin Engineering and Manufacturing Development phase by holding a Milestone B decision. What that means, is, for example, for a program with a projected June 2017 Milestone B, the funding for that program will be in the President's Budget presented in Feb 2016. Congress will need to have started its oversight of this investment before that budget comes in and must conclude before markup. This criterion would provide a list of programs that Congress can most influence. Based on that approach, as a starting point, congressional oversight could focus on ensuring sound acquisition strategies using knowledge-based acquisition principles are established for the following three programs projecting Milestone B's in fiscal year 2017: (1) Presidential Aircraft Recapitalization; (2) Unmanned Carrier-Launched Airborne Surveillance and Strike System; and (3) Joint Surveillance Target Attack Radar System Recapitalization.

In addition, our March 2015 assessed ongoing programs against acquisition best practice criteria to identify specific acquisition risks. The risks we reported provide an opportunity for targeted congressional oversight of programs already underway. We will be publishing our next annual assessment of selected weapons programs later this spring which will include updated assessments. [See page 29.]

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

OCTOBER 27, 2015

QUESTIONS SUBMITTED BY MR. THORNBERRY

Mr. THORNBERRY. What can be done to encourage more incremental development and deployment of weapon systems?

Mr. HUNTER. Some of the concepts required for incremental development, such as planning and developing "Blocks" of capability that are separately or sequentially developed over time and programs to prototype new systems and subsystems, already exist. An example is in the F–35 program, in which the Department has been planning and developing Block 4 capabilities for F–35 even as it works to develop and deliver Block 2B capabilities that are being used by the United States Marine Corps and Block 3F capabilities that are being used by the United States Air Force in their initial operation of the F–35. Another example is the separate development of mission modules for the Littoral Combat Ship (LCS). However, the approach to blocks of capability that prevail in today's programs remains focused on developing and delivering full system sets of capability that are tightly integrated, and that as a result, take many years to plan, program and deliver. While this approach is faster and probably cheaper than having entirely separate acquisition programs, it still does not match up well with the pace of technology innovation. It is necessary to supplement the Block approach by decomposing system level requirements into smaller sub-increments or "packages" of capability that correspond to the subsystem design level. This would allow the incremental development of these packages of capability that can be designed, prototyped, tested, and relatively rapidly deployed, in months rather than years, allowing for the incremental development and deployment of technology at the subsystem level. A potential barrier to this approach is in the challenge it presents to "baselining" systems for purposes of budgeting, scheduling, testing, and tracking program execution. Congress should work with the Department to establish a more dynamic approach to baselining acquisition programs where incremental development and rapid deployment are identified as priorities.

Mr. THORNBERRY. What must change in the DOD acquisition process and culture to better transition technology from the "lab" to a program of record?

Mr. HUNTER. The key gap in the current system for transitioning technology from the lab to programs of record and fielded system is the fact that while experts within the DOD enterprise have tremendous awareness and knowledge of technology developments (developments in the "lab") across the full spectrum of the in-house and industry-led technology sectors, this knowledge is not spread broadly across the enterprise, and in particular, it is frequently not the case that decision makers in the requirements and resourcing communities have knowledge of the latest technology developments. So there is a gap in turning expert knowledge into enterprise knowledge that can be acted on by DOD leadership. Similarly, the number of opportunities for technology insertion in programs of record and fielded systems are too far apart. In the worst case scenario, a program could go from Milestone B all the way to full rate production and Full Operational Capability (FOC), usually a period of roughly ten years, without significant consideration of technology insertion beyond the minimum needed to address issues of obsolescence. Many programs work to create some additional technology insertion points in between these major program phases, but they are essentially working against the system in doing so. In contrast, the pace of technology change suggests that technology insertion points need to occur no less frequently than every six months. The Department traditionally addresses this need to create additional opportunities for technology insertion by creating "Blocks" of capability that deliver incrementally over time. However, in most cases these blocks are themselves separated by several years of time. Creating additional opportunities for technology insertion requires allowing the requirements, budgeting, and acquisition processes to decompose system-level requirements into sub-increments, "packages," such that these sub-increments could be swapped out or updated independently on a timeline of months rather than years.

Mr. THORNBERRY. What is needed to achieve integration of the requirements and acquisition processes in the DOD to facilitate requirements tradeoffs prior to acquisition programs being initiated?

Mr. HUNTER. The requirements and acquisition communities need to be in continuous dialogue on trade-offs relating to acquisition programs before program initiation and during program execution. While this dialogue exists in many ways today, it can be hampered by the fact that both sides are not always speaking the same language (in a figurative sense). That is, the requirements community is talking in

terms of capability gaps and key performance parameters (KPPs), concepts that are fairly absolute and unqualified, while the acquisition community is talking in terms of costs, risks, and timelines for development, things that before program initiation are estimates that are inherently uncertain and imprecise. For the dialogue to be productive, a bridge between these languages is need. In the world of rapid acquisition, this dialogue was bridged by the concreteness of short fielding timelines. Both sides could work backwards from an expected fielding date as a basis for understanding how to characterize bottom-line needs, in the case of the warfighter, and the art of the possible, in the case of the acquisition community. An interesting example of how this was done on a major defense acquisition program was with the Combat Rescue Helicopter program, where Under Secretary of Defense for Acquisition, Technology, and Logistics, Frank Kendall, asked the requirements community to put a dollar value on how much more they would be willing to pay to get a capability that met their objective requirement, rather than just the threshold requirement. The acquisition community was surprised that the requirements community indicated that they would willing to pay only about 10% more to obtain the increased capability of the objective requirement. When this value criterion was incorporated into the Request for Proposals for the program, it had a decisive effect on industry's evaluation of how to compare cost with capability. In the CRH example, the bridge in the conversation came from developing a concrete measure of value in the difference between the threshold and objective requirement.

Mr. THORNBERRY. To what extent is government systems engineering expertise available and applied in the requirements-setting process? To what extent should it be available and applied?

Mr. HUNTER. Systems engineering is fundamental to the process of flowing down requirements in systems design. In this sense, it informs the "requirements" that flow down in the design process from the system level to the subsystem level and on down through the design process. However, systems engineering does not play a large role in the setting of KPPs in the systems-level requirements process as far as I am aware. I can think of one example in my direct experience, on an Army truck program, where the maintainability requirements were modified after initial review in the Defense Acquisition Board (DAB) when it was brought forward by the test and systems engineering communities that the maintainability requirements set for the program exceeded any previously demonstrated standard for similar Army equipment by an order of magnitude. In this way, the systems engineering work that is done in support of the DAB process can, and has on occasion, been used as an impetus to revisit the requirement, and in the case of the Army truck program, the Army requirements community revisited that requirement and established KPPs more in line with previous Army experience. If the requirements process is modified as suggested in my answers above to decompose requirements that allow for more incremental development at the subsystem level, systems engineering would have to play an increased role in the requirements process to ensure that system integrity is not compromised.

Mr. THORNBERRY. What capabilities or efforts may be needed to streamline the DOD's requirements and acquisition review and approval processes to increase "speed to market" or getting the right weapon systems from concept to fielding?

Mr. HUNTER. In addition to turning expert knowledge about technology developments into enterprise knowledge that can drive action, and decomposing system-level requirements and adding additional technology insertion points to enable incremental development, review and approval processes should move from processes that focus on examining documents in sequential fashion for procedural compliance to processes with greater direct interaction and involvement of the various stakeholders focused on developing a common understanding of the strategy being pursued, the risks being taken, the plans for risk mitigation, and the benchmarks of success. The goal should be for the acquisition community to leave these sessions prepared to support the program manager in pursuing the program, rather than a situation where the larger acquisition community observes from the sidelines looking for stumbles.

Mr. THORNBERRY. Are there lessons learned from the Department's rapid acquisition programs that can be applied to accelerate other DOD acquisition programs?

Mr. HUNTER. Absolutely. Chief among these is the need for continuous dialogue between the acquisition and requirements communities that updates and informs those setting requirements on the likely costs, timelines, and results of development efforts and that allows the requirements community to rapidly inform the acquisition community about emerging threats and to refine requirements as additional information about technology developments emerges. This ability for the two sides to meet regularly and exchange information regarding urgent operational needs was a powerful mechanism for accelerating action and it is applicable in many ways to

other kinds of acquisition programs. Another key for rapid acquisition was the support of senior leadership to overcome obstacles by identifying and transferring funding ahead of the normal funding cycle, approving waivers or taking extraordinary action to acquire long-lead items when necessary, and alerting other offices throughout the Department to move rapid acquisition programs to the front of the queue whenever approvals were required. Because it is difficult for senior leadership to play this sort of role in a large number of cases, it was critical that the rapid acquisition process was associated with a discrete, definable universe of urgent operational needs with a proven and credible requirements approval process. Lastly, the availability of flexible funding was essentially to avoiding the long delays associated with obtaining funding for new start programs, a process that generally delays even the initiation of action on new efforts by at least two years.

Mr. THORNBERRY. What can be done to encourage more incremental development and deployment of weapon systems?

Dr. CHU. Incremental development and deployment, as the Committee appreciates, is a design and acquisition strategy. The decision to employ it must weigh its benefits, and their likely realization, against the costs, and the realism of those cost calculations. One benefit may be more rapid fielding, depending on the circumstances involved; another may be the ability to adjust the article's features in response to early field experience or evolving threats; yet another could be capitalizing promptly on research progress. One downside may be the additional complexity (and cost, e.g., for training) that deploying a variety of models could entail.

Accepting the premise that benefits will at least sometimes outweigh costs (certainly true of several major system upgrades over the last two decades, which constitute one version of incremental development), it may be sufficient to ensure that this alternative strategy is one of the options considered by the Analysis of Alternatives that should precede any major investment decision. The evidence on benefits and costs should be sufficiently persuasive to make the case for selecting the strategy.

Acknowledging that systems will change in response to early field experience will reinforce that case. Indeed, anticipating the need for changing configurations will reinforce the case for an incremental approach. But it does require that the design effort facilitate such changes (for example, by providing larger margins for weight growth, or space and power for additional features). Two of my colleagues make the case for just such an approach in their aptly titled paper, "Prepare to Be Wrong".[1]

As Patel and Fischerkeller argue, this approach advantages the adaptability of equipment as circumstances change. In its 2010 Summer Study, the Defense Science Board recommended that we tie program objectives to planned deployment dates, to buttress just such adaptability. Doing so also places a premium on constraining development objectives, in order to enhance the likelihood that the needed schedule will be honored.[2]

In short, three managerial tools may produce a greater use of incremental development: explicit consideration in AoAs, generous margins for changes, and using deployment dates as a disciplinary instrument.

Mr. THORNBERRY. What must change in the DOD acquisition process and culture to better transition technology from the "lab" to a program of record?

Dr. CHU. In my judgment, the fundamental problem lies in the current incentives facing the potential acquisition partners—government labs, the Military Services, the Defense Advanced Research Projects Agency, and private industry. While all generalizations are risky, the current incentives for government labs focus their efforts on improving existing equipment, supporting existing Service concepts of operation, not on generating new ideas per se. The Services, which control the "requirements" process, tend to focus on their views of operational needs, sometimes only vaguely informed by what might be technologically feasible. To the extent the Services consult the technical community, beyond their immediate staffs and those of their OSD overseers, the exchange centers on the dialogue with private industry via development contracts. It's well established that industry sees the development contract as an economic "prize", leading to the source of most profit in the American system—the production of finished articles.[3] Provided the proposed development

[1] Patel, Prashant R. and Michael P. Fischerkeller, "Prepare to Be Wrong: Assessing and Designing for Adaptability, Flexibility, and Responsiveness", ISA P–5005, April 2013.

[2] See *Report of the Defense Science Board 2010 Summer Study on Enhancing Adaptability of U.S. Military Forces: Part A: Main Report.* Washington, DC: Under Secretary of Defense, Acquisition, Technology, and Logistics (USD[AT&L]), January 2011, p. viii–x.

[3] See William P. Rogerson, "Profit Regulation of Defense Contractors and Prizes for Innovation", Journal of Political Economy, Vol. 97, No. 6, December 1989, pp. 1284–1305.

contract responds reasonably to "requirements", there is no particular incentive for private industry to work with the labs.

Accepting these generalizations as broadly applicable, if there is a desire for government labs to play a larger role in the development process, incentives must be adjusted. A mechanism to reward the labs for generating successful ideas is required, as a necessary condition. In the private sector for civilian products, that mechanism is the return that accrues from intellectual property. A simplistic analogue for the government lab would be some financial return for "successful" ideas.

But that alone would be insufficient, without a mechanism that encourages a dialogue between the government labs and the Military Services, and among the labs, the Military Services, and the producing contractors. Could some early development work be awarded the labs, presumably based on the potential excellence of their early ideas (which by itself might provide a needed financial incentive)? Would it be feasible to create partnerships between government labs and production firms that did not generate undesirable conflicts of interest? Might one form of partnership be development of operational prototypes embodying new technological approaches? Could that enhance a culture of experimentation, using experiments with prototypes to sharpen the appreciation of both real-world limits and the tradeoffs that must be confronted? Would that also help DARPA test its best ideas?

If successful, such changes in incentives would change the routine behavior of the acquisition process participants. But it is also possible to over-ride current routine behavior using the Secretary's (or Congress') authority, nurturing promising technologies that the labs might develop until they take root. It might be argued that is how cruise missile technology became such an important part of the defense portfolio. In the best of all possible worlds such nurturing might bridge the transition to a better set of incentives, worked out through trials of the sorts of ideas sketched above, both to explore their feasibility and yield insights into the unintended consequences against which the Department must protect itself and the public interest.

Mr. THORNBERRY. What is needed to achieve integration of the requirements and acquisition processes in the DOD to facilitate requirements tradeoffs prior to acquisition programs being initiated?

Dr. CHU. "Requirements" cannot be separated from the "physics" of the problem—that is, the trade space among potential attributes for a system that technology provides. The technology constraint (the "frontier") may not be a bright line, but rather more likely a fuzzy zone. As you approach it, and perhaps try to move toward its outer boundary (or beyond), costs and risks increase, arguably substantially—even in a nonlinear fashion.

With a healthy respect for where that fuzzy zone begins, it's typically feasible to depict the tradeoff space among attributes of a potential system quantitatively. Approaches to do so are available.[4] They are not extensively utilized, but should be. Effective utilization will require appropriate "human capital" (perhaps capitalizing on what some of the Federally Funded Research and Development Centers can provide)—and a bureaucratic process sympathetic to their intent. The last will require significant leadership from the Department's seniors.

A complementary approach is to re-invigorate the use of Analyses of Alternatives (which will also require leadership from the Department's seniors). The alternatives considered could include alternative bundles of the desired system attributes, thus illustrating the benefits, costs and risks of the tradeoffs involved. AoAs should respect the uncertainties of future operational environments, and of the fiscal limits under which the proposed system solution must be pursued, constraining the tradeoff choice to one that is realistic in the context of likely future budgets.[5]

A final promising ingredient is to encourage a series of "feedback" exchanges with those who will use the proposed system, requesting their vision(s) of how the system might be employed, recognizing the limitations of their abilities to foresee how that might actually develop. (The challenge is reflected in the allegation that had we asked cargo users what they wanted at the dawn of the automotive age, they might have replied "a faster, stronger mule"!)

Mr. THORNBERRY. To what extent is government systems engineering expertise available and applied in the requirements-setting process? To what extent should it be available and applied?

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[4] See, for example, Patel, Prashant, et al, "Defining Acquisition Trade Space Through 'DERIVE'", *IDA Research Notes, Acquisition, Part 1: Starting Viable Programs,* Fall 2013.
[5] The Army's critical self-examination of its acquisition system's performance noted the "weak" use of AoAs. See *Army Strong: Equipped*, Trained and Ready: Final Report of the 2010 Army Acquisition Review, January 2011, p. x (sometimes known as the Decker-Wagner study, after its two co-chairmen, Gilbert F. Decker and Louis C. Wagner).

Dr. CHU. The Weapons System Acquisition Reform Act of 2009 appropriately mandated a resurrection of DOD developmental testing capacity, and improvements in systems engineering capacity, but the full realization of WSARA's vision will require yet more effort. These two capacities should be foundational elements in the early DOD Milestone deliberations—they should have proverbial "seats at the table", perhaps more elevated seats than they currently enjoy.

How much capacity is needed will differ by warfare area. Some of the needed capacity may be provided by the Federally Funded Research and Development Centers. There is unlikely to be an easy generalization about overall needs.

Applying these capacities energetically will require the commitment of the acquisition community leadership, accepting the tensions that competing perspectives can generate. All concerned must be willing to accept some of the "hard truths" that these communities so often provide—especially about competing or incompatible "requirements".

Mr. THORNBERRY. What capabilities or efforts may be needed to streamline the DOD's requirements and acquisition review and approval processes to increase "speed to market" or getting the right weapon systems from concept to fielding?

Dr. CHU. As I testified, cycle time (presumably the motivation for streamlining) may not be quite the issue we imagine. But as I also testified, many of the oversight and reporting burdens are symptoms of the problem we face, not the cause. Government decisions, especially the high-profile decisions associated with major weapon systems, are inherently political. Given the decided lack of sympathy for error, we should not be surprised that managers at every level demand significant, careful review before each step is taken. In my judgment, a greater political tolerance for "mistakes"—an "error budget", so to speak—would eventually allow us to streamline the process.

But we can also speed delivery by more frequently considering alternatives that update existing systems instead starting afresh. Modifying what we already have to aim at the desired performance (or cost) improvement should be a consistent option in Analyses of Alternatives. The relative success of the F/A–18 E/F program provides an example worth considering. It may also illustrate the limits of this approach.

We can likewise start with articles developed outside the United States. The rapidity with which we could deploy the Mine Resistant Ambush Protected Vehicles illustrates the potential of this alternative—as well as its limitations.

And perhaps most important, if we honor the limits of what's technically realistic in the design tradeoff selected, as I argue in response to Question 3, and if we are faithful to what's really needed in systems engineering and developmental testing (Question 4), we are much more likely to field articles expeditiously—articles that shine in their operational tests, and that live within the cost limits we need to impose. Indeed, as I speculate in response to Question 1, if we start with the desired fielding date as a key parameter driving program design, allowing adequate margin for incremental improvements, we may reach the result to which so many aspire—acknowledging that there are some technical developments that may require long periods of investment, notwithstanding the preference for quick results, as the history of the pure power geared turbofan aircraft engine demonstrates.[6]

Mr. THORNBERRY. What can be done to encourage more incremental development and deployment of weapon systems?

Mr. PASQUA. Massive improvements in incremental development and deployment practices have been a major contributor to rapid growth in the Tech Industry over the past decade. There are several contributors to these improvements. First, there has been a move to the notion of "minimum viable product" or MVP. A MVP contains only those features which are required to meet key requirements while providing a basis on which new features may be added over time without re-engineering the entire platform. This allows products to get to market sooner, provide tangible customer value, garner feedback, and be enhanced to provide enhanced functionality that may not have been anticipated or prioritized before real usage. To make the MVP approach work, one must embrace a continuous deployment process. That is, it must be possible to enhance the deployed product rapidly without requiring major infrastructure changes or end-user retraining. Because this can be more difficult to do with hardware systems, more and more systems are "software defined". This allows the hardware to provide a flexible substrate that can be molded to meet new requirements with software. Incremental development can't work if the specs/requirements are overblown to begin with or if there is no way to practically deploy incremental improvements.

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[6] See Coy, Peter, "The Little Engine that Could Reshape the Jet Engine," *Bloomberg Businessweek,* October 19–25 edition.

Mr. THORNBERRY. What must change in the DOD acquisition process and culture to better transition technology from the "lab" to a program of record?

Mr. PASQUA. Navigating a large bureaucracy can be difficult, but it can be achieved by finding a customer that demands a product. This takes the acquisition process out of the realm of the theoretical, and is achieved by strengthening the bond between the customer and the "lab" or the developer. There are two primary ways to achieve this. First, an organization can allow the lab to have greater access and contact to the end-users in the field. This may not be feasible, however, for a variety of reasons, including the risk of fielding unproven technology. Therefore, the second way is to bring the end-users into the lab. Often an end-user doesn't actually know what he requires until a prototype is developed. Building a stronger connection to the lab allows the customer to provide rapid feedback on prototypes as they are developed. One of the benefits is not only the real time test and evaluation, but also the dialogue on what is possible. The operational work force may not have the technical knowledge to articulate challenges to consider for technical solutions because they are not informed on what are the current outer limits of technical capability. Bringing the lab to the field reduces that knowledge gap by bringing the science and technology closer to the problem, educating the operational work force on the realistic bounds of current capabilities, and illuminating operational challenges for the science and technology work force to provide vectors for innovation. Thus, better transitioning technology from the lab to the customer can be achieved by strengthening the bond between the two; in essence: bringing the lab to the field, or vice versa.

Mr. THORNBERRY. What is needed to achieve integration of the requirements and acquisition processes in the DOD to facilitate requirements tradeoffs prior to acquisition programs being initiated?

Mr. PASQUA. In larger organizations, often requirements are set and given to the developers without the latter being included in the requirements process. A stronger and more responsive feedback loop between the requirement setter and the developer is necessary to identify and reconcile any tradeoffs before a product is engineered and acquired. Often, organizations conduct market research to inform their requirements for a product. However, while all of those requirements may be true, they may not all be essential. Yet, because the developers are left out of the requirements process, they will engineer according to the requirements they are given, regardless of need (i.e. perhaps a 70% solution is sufficient) or cost (i.e. perhaps a 100% solution would double the cost of the program). Absent a strong link between need and cost, there is a risk of over-engineering a solution or spending too much. To avoid this challenge, there should be a responsive feedback loop between the requirements setter and the developer. It should be part of the developer's (or Research & Development team's) responsibility to meet with the customer and agree on the need and cost before embarking on the acquisition process. Often, the larger the organization is the more specialization there is. This specialization only creates more layers between the developer and the customer, and risks weakening the link between need and cost.

Mr. THORNBERRY. To what extent is government systems engineering expertise available and applied in the requirements-setting process? To what extent should it be available and applied?

Mr. PASQUA. Although I am not in a position to comment on the availability of systems engineering expertise available within the Department, I can say that in the private sector the importance of having the expertise available is growing. The rapid deployment and iterative development of products and systems requires this expertise. In industry, we struggle with the question of how to build more modular and adaptable platforms that allow us to incorporate innovation over time. This is a systems engineering issue. For example, open architecture is now part of the lingua franca of software development and implementation. The same can and should be said for major Acquisition Category (ACAT) I programs. My sense is that should systems engineering expertise been available and applied during the acquisition cycle for the now cancelled USMC Advanced Amphibious Assault Vehicle (AAAV) program, outcomes may have been very different. As requirements grew in the development phase to ultimately unsustainable levels, a system engineering perspective could have identified the technological and fiscal impracticality of proposed adjustments before they were articulated to the contracted developer.

Mr. THORNBERRY. What capabilities or efforts may be needed to streamline the DOD's requirements and acquisition review and approval processes to increase "speed to market" or getting the right weapon systems from concept to fielding?

Mr. PASQUA. Industry looks like it is moving quickly because we are seeing the aggregate progress made by an entire ecosystem of organizations. Individually, many projects within these organizations fail, but the overall effect is fast forward

progress spurred on by competitive pressure. The DOD may benefit from an approach that allows more small scale experiments to occur quickly to ensure the feasibility of new approaches and their suitability to the requirements. There will be more small scale failures, but the ultimate result will be faster time to fielding of capabilities that are best suited to the needs. In some cases a "minimum viable product" approach should be employed that allows a capability to be fielded sooner and improved later.

Mr. THORNBERRY. What additional steps are needed to ensure industry understands what the Department's capability needs are for the future?

Mr. PASQUA. Beyond Defense Contractors and specialized commercial organizations, there is very little understanding of the Department's capability needs, how to learn them, and how to navigate the procurement process. Unless the last item is addressed, industry won't feel a strong need to overcome the first two items. Having said that, outreach events including both academia and industry can be quite helpful. Establishing a network of individuals and organizations from industry who are co-sponsors of these events can help to attract the right attendees. For example, the Venture Capital community can be leveraged to bring new innovative companies from their portfolios to sessions to learn more about the Department's needs. Organizations like BENS also have members with broad networks who could also help attract key participants. In addition to understanding the Department's capability needs, I believe it would be valuable for industry to understand more about the missions to which these capabilities are in service. I find that once people understand the importance of the mission, they are more motivated to find a way that their organizations can contribute.

Mr. THORNBERRY. What can be done to encourage more incremental development and deployment of weapon systems?

Mr. FRANCIS. Greater discipline by DOD when setting requirements and when establishing business cases, as well as reinforcement through congressional oversight will be needed to encourage more incremental development and deployment of weapon systems.

DOD will need to better integrate the requirements development and acquisition processes so that trade-offs informed by systems engineering take place before programs start. This will require a recognition by DOD officials that requirements cannot be truly set and a sound, incremental business case established until the requirements technical feasibility and affordability can be fully determined. Our recent work shows that DOD officials appear to recognize the need to take additional steps. We reported in June 2015 that "Several service chiefs noted that more integration, collaboration, and communication during the requirements and acquisition processes needs to take place to ensure that trade-offs between desired capabilities and expected costs are made and that requirements are essential, technically feasible, and affordable before programs get underway".

In addition, every year, there is what one could consider a "freshman" class of new acquisitions. DOD and Congress must ensure that these programs embody the right principles and practices, such as incremental acquisition strategies, and make funding decisions accordingly. Through our reports and testimonies we have determined that a key enabler to getting better acquisition outcomes is establishing an incremental, knowledge-based acquisition strategy. However, there are strong incentives within the acquisition culture to overpromise a prospective weapon's performance while understating its likely cost and schedule demands. Encouraging more incremental development and deployment of weapon systems will take the joint efforts of Congress and DOD. As I recently testified, the principles and practices programs embrace are determined not by policy, but by decisions. These decisions involve more than the program at hand: they send signals on what is acceptable. Programs that present well-informed acquisition strategies with reasonable and incremental requirements and reasonable assumptions about available funds should be given credit for a good business case and funded. Similarly, a few healthy "No's" by DOD decision makers and Congress to programs that request to begin without a sound foundation, including incremental approaches, would go a long way toward shaping the expectations of programs and contractors as to what is acceptable.

Mr. THORNBERRY. What must change in the DOD acquisition process and culture to better transition technology from the "lab" to a program of record?

Mr. FRANCIS. DOD has long noted the existence of a chasm between its science and technology community and its acquisition community that impedes technology transition from consistently occurring. This chasm, often referred to by department insiders as "the valley of death," exists because the acquisition community often requires a higher level of technology maturity than the science and technology community is willing to fund and develop. We have reported extensively on shortfalls across DOD's technology management enterprise in transitioning technologies from

development to acquisition and fielding. In June 2005, we found that DOD technology transition programs faced challenges selecting, managing, and overseeing projects, and assessing outcomes. In September 2006, we found that DOD lacked the key planning, processes, and metrics used by leading commercial companies to successfully develop and transition technologies. In March 2013, we found that the vast majority of DOD technology transition programs provide technologies to military users, but tracking of project outcomes and other benefits derived after transition remained limited. More recently in November 2015, we found that programs progress through Defense Advanced Research Projects Agency (DARPA) without the agency head fully assessing whether transition strategies make sense. Such assessments, if measured against key transition factors, could improve a program's potential for transition success. Transition responsibilities then fall almost exclusively on individual program managers, who are often not sufficiently trained to achieve the favorable transition outcomes they seek. Further, when the program manager's tenure expires, the primary advocate for transitioning the program's technology is also lost. This turnover increases the need for technical gains to be appropriately documented and disseminated so that user communities have visibility into potential solutions available to meet their emerging needs. An important part of this process is the tracking of transition outcomes, as we recommended DOD undertake for its technology transition programs in March 2013, and which we have also found lacking at DARPA. Our recent November 2015 review of technology transitions at DARPA offers a place to start. While there are a number of factors that determine whether a technology effort successfully transitions to a program of record, we found that science and technology development organizations should regularly assess technology transition strategies, improve transition training for Science and Technology program managers, and increase sharing of technical data on completed programs. Among the most significant factors that contribute to transition success are whether there is military or commercial demand for the planned technology, linkage to a research area of sustained interest by DARPA, active collaboration with potential transition partners and achievement of clearly defined technical goals. Finally, there is the issue of money. Technologies and concepts that are taken to a higher level of demonstration are more likely to transition to programs successfully. This is key to success in the private sector. But taking technologies to higher levels of demonstration is expensive. It is often difficult for DOD labs to afford such demonstrations. Conversely, programs of record have much higher levels of funding available, which creates incentives to transition technologies sooner than in the commercial world. This can have negative consequences for transition. For example, a program may be less willing to accept a technology that a lab has not been able to fund to higher levels of demonstration. Also, technologies that do transition early may cause problems for programs of record because they will still be going through the discovery process associated with higher levels of demonstration, with attendant discovery of problems and complications. While normal for technology demonstration, this is disruptive for a program of record that is operating within a formal cost and schedule baseline.

Mr. THORNBERRY. What is needed to achieve integration of the requirements and acquisition processes in the DOD to facilitate requirements tradeoffs prior to acquisition programs being initiated?

Mr. FRANCIS. This year's NDAA took several steps to increase the role and formal authority of the service chiefs and ensure they are consistently involved in program decisions. In addition, as I testified to in 2013, DOD's better buying power initiatives are also having a positive effect including making early trade-offs among cost, schedule and technical performance requirements. However, more can be done. Most current and former military service chiefs and vice chiefs GAO interviewed from the Army, Air Force, Navy, and Marine Corps in our June 2015 report collectively expressed dissatisfaction with acquisition program outcomes and believed that the Department of Defense's (DOD) requirements development and acquisition processes need to be better integrated. Several service chiefs noted that trade-offs informed by systems engineering must take place before programs start so that requirements are better defined and more realistic cost, schedule, and performance commitments can be made. GAO recommended that DOD ensure sufficient systems engineering is conducted to better define requirements and assess resource trade-offs before a program starts. DOD concurred with the recommendations, citing recent policy changes. To the extent that service chiefs will be taking an increased role in program decisions, additional consideration should be given to whether they have received sufficient training and experience in acquisition as well as whether they have appropriate staff support to successfully execute these additional duties. Finally, DOD will need to ensure that it has sufficient workforce expertise to provide support during the requirements setting phase. In 2015 we reported that "...in areas

such as cost estimating and systems engineering, our work found that DOD may not have adequate resources to fully implement recent weapon system reform initiatives."

Mr. THORNBERRY. To what extent is government systems engineering expertise available and applied in the requirements-setting process? To what extent should it be available and applied?

Mr. FRANCIS. DOD often does not perform sufficient up-front requirements analysis via systems engineering on programs to determine whether the requirements are feasible and whether there is a sound business case to move forward. Programs continue to be proposed with unachievable requirements and overly optimistic cost and schedule estimates and, usually, participants on both the requirements side and the acquisition side are loathe to trade away performance. Almost all of the service chiefs we interviewed in June 2015 stated that there is a need to further enhance expertise within the government, and several specified expertise in systems engineering. Several service chiefs indicated that systems engineering capabilities are generally lacking in the requirements development process, and do not become available until after requirements are validated and an expensive and risky system development program is underway. Some service chiefs advocated that having systems engineering capabilities available to the military services during requirements development could help to ensure earlier assessment of requirements feasibility. The service chiefs' views on the importance of systems engineering is consistent with our prior acquisition work. We recommended that DOD ensure sufficient systems engineering is conducted to better define requirements and assess resource trade-offs before a program starts. DOD concurred with the recommendations.

Mr. THORNBERRY. What capabilities or efforts may be needed to streamline the DOD's requirements and acquisition review and approval processes to increase "speed to market" or getting the right weapon systems from concept to fielding?

Mr. FRANCIS. The process used to manage the acquisition of weapon systems is inefficient, cumbersome, and bureaucratic. A contributing factor to this inefficient process is the significant time and effort required to complete information requirements before an acquisition program can proceed through a milestone to the next phase in the weapon system acquisition process. DOD leadership has acknowledged that too much time is invested in preparing for key milestones, including the documentation and oversight of information required by statutes and policy, which takes time away from conducting day-to-day core program management tasks such as contractor oversight, engineering, and risk management.

We surveyed 24 programs in February 2015 and found that it took DOD over 2 years on average to complete the entire set of documents required for review and approval at key decision points. In the end, program officials felt almost half of these information requirements were not of high value. The challenge is to find the right balance between having an effective oversight process and the competing demands such a process places on program management. If information requirements and reviews are not clearly linked with the elements of a sound business case and/or the key issues facing acquisitions today, then they can be streamlined or even eliminated. If they are linked, but are not working well, then they warrant re-thinking. These requirements, as well as ones that take a year or more to complete, could serve as a starting point for discussions on what documentation is really needed for weapon acquisition programs and how to streamline the review process. If DOD does not eliminate levels of review, but only makes the existing process more automated, inefficiencies are likely to continue.

We recommended that, in the near term, DOD identify and potentially eliminate (1) reviews associated with information requirements, with a specific focus on reducing review levels that do not add value, and (2) information requirements that do not add value and are no longer needed. We also recommended that, as a longer-term effort, select several current or new major defense acquisition programs to pilot, on a broader scale, different approaches for streamlining the entire milestone decision process, with the results evaluated and reported for potential wider use. DOD concurred with both recommendations. A place for the committee to start would be to monitor DOD's progress implementing these recommendations.

Users may well be willing to live with a less ambitious set of technical outcomes than those at which the technical community is aiming. Or they may want something more, reflecting changes in the operating environment since designs were originally considered, sending us back to the trade space drawing board.

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